PB89-189559

Superfund Record of Decision (EPA Region 5)
Mid-State Disposal Landfill, Marathon County, Wisconsin
(First Remedial Action), September 1988

(U.S.) Environmental Protection Agency, Washington, DC

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Emergency and
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September 1988

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EPA

Superfund Record of Decision:

Mid-State Disposal, WI

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Mid-State Disposal (MSD) site is an abandoned municipal and industrial waste landfill located in central Wisconsin, in Cleveland Township, Marathon County, about 4 miles northeast of Stratford, The area surrounding the site includes an abandoned railroad track partially bounding the west and north, two offsite sludge disposal lagoons owned by Weyerhaeuser, Inc. to the northeast, and private property to the south. Site runoff enters nearby waterways including the Rock Creek and the Eau Plune River via unnamed tributaries. Additionally, ground water from the site is believed to be discharging into a ravine 500 feet south of the site. MSD conducted landfilling operations from 1970-1979, receiving municipal, industrial and commercial wastes as well as construction and demolition debris. Specific wastes received included papermill sludges, asbestos dust, solvents, pesticides, paint sludges and metals. Four areas of contamination have been identified at the site. These are: a 25-acre landfill located in the center of the site and referred to as the Old Mound area, which contains municipal wastes, papermill sludges, asbestos dust, pesticides and solvents; a 5-acre interim expansion landfill located to the west of the Old Mound area and referred to as the Interim Expansion area, which reportedly contains wastes similar to the Old Mound area with the exception of papermill sludges; a 3-acre sludge lagoon located northwest
(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision
Mid-State Disposal Landfill, WI
First Remedial Action - Final
Contaminated Media: gw, sw, soil
Key Contaminants: metals, VOCs (PCE, TCE)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 62
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16. ABSTRACT (continued)

of the Old Mound area which allegedly contains papermill sludges; and an area along the western edge of the property where leachate ponding had occurred. Numerous environmental problems and permit violations were noted by the Wisconsin Department of Natural Resources (WDNR) during a site inspection in 1974. In 1979, Weyerhaeuser Company, a generator of waste disposed at the facility, agreed to properly abandon the facility. The pond leachate was removed, and the three waste disposal areas were covered. Leachate collection systems were installed in late 1979 for both the sludge lagoon and the Interim Expansion area; only the leachate collected from the latter is currently removed and treated offsite. Subsequent investigations revealed that ground water has been contaminated by leachate percolating from the waste disposal areas and the leachate pond down to the underlying aquifer. The primary contaminants of concern affecting the ground water, surface water and soil are VOCs including benzene, PCE and TCE, and metals.

The selected remedial action for this site includes: installation of new soil/clay caps for the lagoon and landfills; site monitoring that includes ground water, surface water, and landfill gas monitoring; offsite ground water monitoring; provision of an alternate water supply for nearby residences; improvement of surface water drainage; leachate and ponded water collection and offsite treatment; access restrictions; stitutional controls to prevent well installation onsite; and in situ solidification/ bilization of sludge as necessary for cap support, and landfill gas flaring, if deemed necessary during pre-design. The estimated present worth for this remedial action is $16,000,000 with annual O&M of $22,000 for the first year, and $100,000 for years 2-30.

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Record of Decision

Site Name and Location

Mid-State Disposal Landfill
Marathon County, Wisconsin

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Mid-State Disposal Landfill Site in Marathon County, Wisconsin, developed in accordance with CERCLA, as amended by SARA and, is consistent to the extent practicable, with the National Contingency Plan (NCP). This decision is based on the administrative record for this site. The attached index identifies the items which comprise the administrative record upon which the selection of the remedial action is based.

The State of Wisconsin concurs in the selected remedy.

Description of the Remedy

The selected remedial action alternative for the Mid-State site addresses the source of contamination through the installation of new landfill caps to prevent migration of hazardous compounds, to reduce associated contaminated materials, and prevent direct human contact with landfill contents and lagoon waste. An alternate water supply will protect those residents threatened by potentially contaminated groundwater.

The major components of the selected remedy include:

- Site capping with a soil/clay cap that meets State solid waste landfill requirements will minimize leachate generation and prevent direct contact with contaminated materials.

- Site monitoring will be conducted that includes groundwater, surface water, and landfill gas monitoring to determine the effectiveness of the above measures and provides early warning as to the need for other actions.

- Alternate water supply to protect against potential future ingestion of contaminated groundwater.

- Improvement of surface water drainage.

- Off-site treatment of leachate.

- Site fencing and sign posting for security.

- On-site road construction.

- Institutional controls to prevent well installation within the site boundary.

The following components will be evaluated during the pre-design and will be included if required:

- Landfill gas flaring
- Sludge stabilization

The action will require operation and maintenance activities to ensure continued effectiveness of the remedial alternative, as well as to ensure that the performance meets applicable State and Federal surface and groundwater requirements.

I have determined that the action being taken is consistent with Section 121 of SARA. The State of Wisconsin has been consulted and concurs with the selected remedy.

Declaration

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate for this remedial action, and is cost-effective.

This remedy utilizes permanent solutions to the maximum extent practicable for this site. However, it was determined that treatment of either source materials or groundwater would not be practicable at the site and, consequently, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

The size of the landfill and the fact that there are no on-site hot spots that represent the major sources of contamination, indicate that treatment is not practicable at the site. Because this remedy will result in hazardous substances above health-based levels remaining on-site, a review will be conducted once every 5 years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

for Frank M. Covington

Valdas V. Adamkus
Regional Administrator

9/30/88
Date

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RECORD OF DECISION

ROD Decision Summary
Mid-State Disposal Site
Marathon County, Wisconsin

I. Site Description

The Mid-State Disposal site is located in central Wisconsin, in Cleveland Township, Marathon County, about 4 miles northeast of Stratford and about 18 miles southwest of Wausau. The site is bounded on the west and north by the now abandoned Chicago and Northwestern railroad track. To the northeast are two off-site sludge disposal lagoons owned by Weyerhaeuser, Inc. To the south, the site is bounded by privately owned property. Figure 1 shows the site in relation to the surrounding areas. Nearby waterways include the Rock Creek and the Eau Pleine River which accept run-off from the site via unnamed tributaries.

The Mid-State Disposal site consists of a 25-acre landfill, the Old Mound area, a 5-acre interim expansion landfill, the Interim Expansion area, and a 3-acre sludge lagoon. In addition, there is an area along the western edge of the property where leachate ponding had occurred in the past (Figure 2). During the period of its operation from 1970 to 1979, the Mid-State Disposal site received domestic, industrial, commercial, and institutional wastes, as well as construction and demolition debris. These wastes included papermill sludges, coating sludges, flyash, asbestos dust, mineral core waste, glue waste, solvents, pesticides, paint sludges, and heavy metals.

The geology of the site consists of ground moraine till overlying saprolite (weathered zone), which is underlain by methorphic fractured-bedrock. The thickness of the till and saprolite varys from 0 to 23 feet and 2 to 7 feet, respectively. Fracturing within the bedrock extends beyond 70 feet, which was the maximum depth of drilling performed during the RI. The bedrock surface slopes west along the western side of the site and east along the eastern side of the site. The bedrock becomes more competent about 10 feet below rock surface, but is still weathered along zones of more intensive facturing.

Horizontal flow in the bedrock is partially controlled by two groundwater divides. One groundwater divide is oriented north-south below the eastern edge of the Old Mound area, which parallels the axis of the bedrock ridge found in this area. West of this divide, groundwater flows at a rate of 1200 ft/yr from the north and south toward the center of the Old Mound Area, and then in a westerly direction. East of this divide, groundwater also enters the site from the north and south, but then flows to the east at a rate of 125 ft/yr. The other groundwater divide, which is oriented east-west, lies at the southern edge of the Old Mound area. Although available data cannot fix the position of this divide with great confidence, a southerly flow most probably occurs originating at the southern end of the Old Mound area.

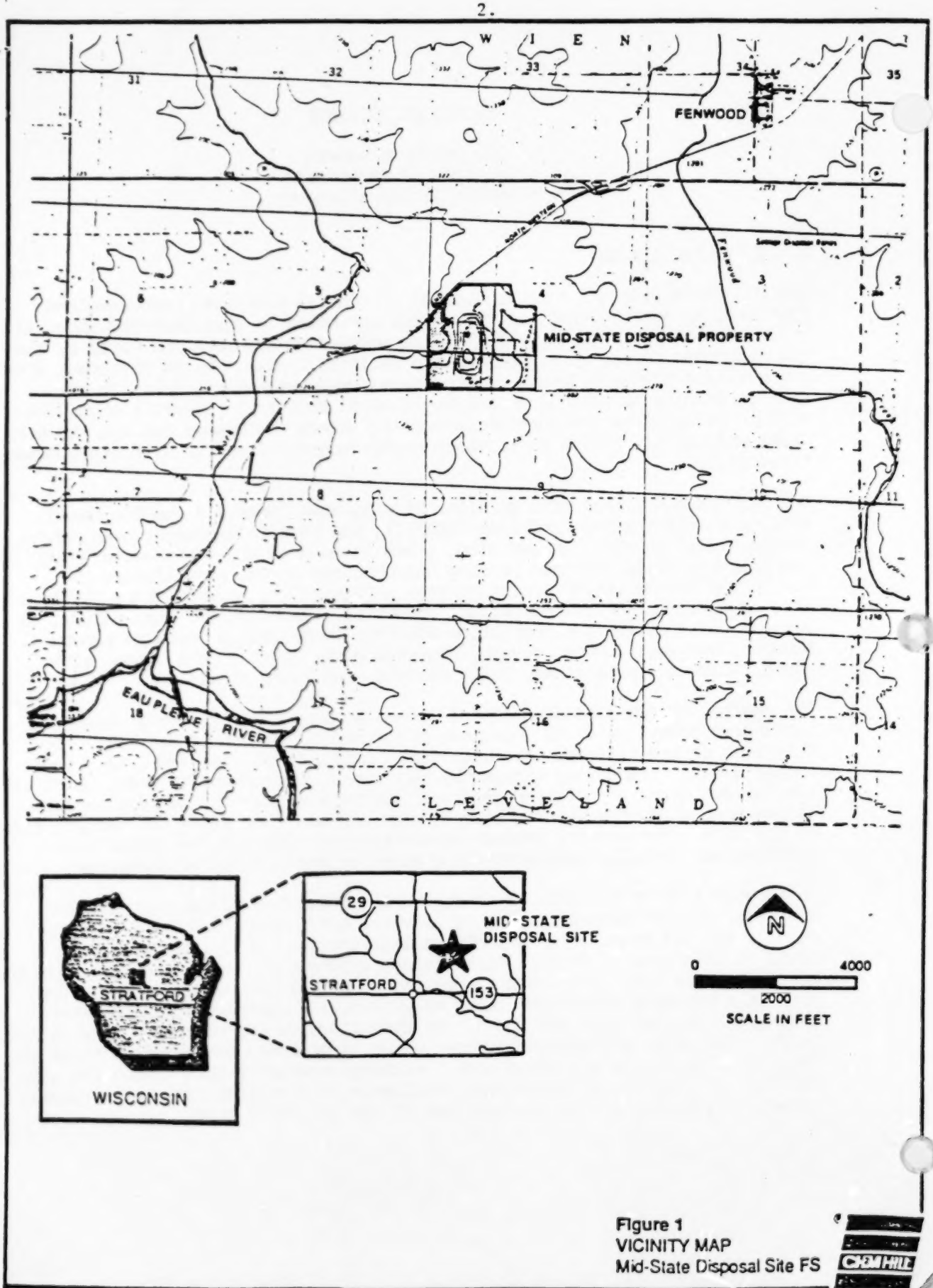

Figure 1
VICINITY MAP
Mid-State Disposal Site FS

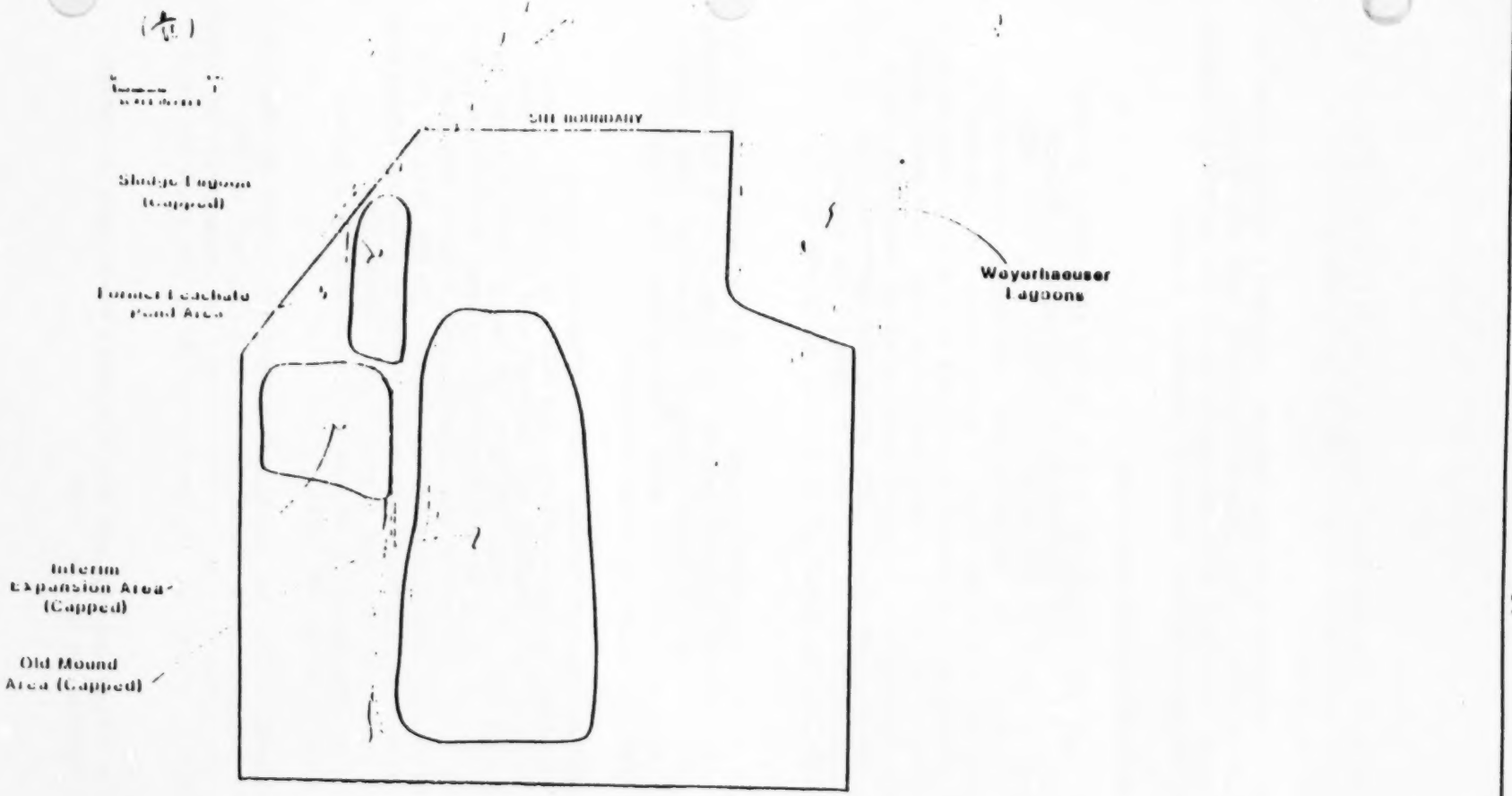

Figure . 2
SITE MAP
Mid State Disposal FS

Directly 500 feet south of the Old Mound area, across Big Rapids Road, is the head of a ravine where groundwater is believed to be discharging in a southerly flow from the site.

The Old Mound landfill contains municipal wastes, papermill sludge, asbestos dust, pesticides, and solvents. The Interim Expansion area reportedly contains the same types of wastes with the exception of the papermill sludges. The sludge disposal lagoon allegedly contains papermill sludges.

II. Site History and Enforcement Activities

Landfilling of municipal and industrial wastes at the site began in 1970 by Mid-State Disposal, Inc. after the Wisconsin Department of Natural Resources (WDNR) granted approval for these activities. In 1977, WDNR approved plans for closure of the Old Mound area, and construction of the sludge lagoon. Operation of the new waste disposal areas was approved in 1978. Environmental problems and permit violations at the site were noted in 1974 when WDNR inspected the site for compliance with their new solid waste disposal regulations. Violations included landfilling of hazardous waste, excessive leachate ponding, and landfilling beyond the approved area. A large leachate pond had also formed along the western edge of the property. A berm retaining leachate on-site was breached on several occasions during the late 1970s.

In response to these violations, WDNR brought legal action against Mid-State Disposal, Inc. A judgement was entered against the firm in 1977 for improper closure and abandonment of the Old Mound landfill. Since that time, several other legal actions and complaints have been filed against the disposal company, including some initiated by local residents.

In 1979, an agreement was reached between the Weyerhaeuser Company, a generator of waste disposed at the facility, and WDNR, to properly abandon the facility. The existing ponded leachate was removed, and the three waste disposal areas were covered. In 1980, the U.S. EPA began investigating the site as a candidate for inclusion on the Superfund National Priorities List (NPL). In 1983, the State terminated its legal actions against Mid-State Disposal, Inc. because the Corporation lacked assets. In the fall of 1983, U.S. EPA Superfund monies were obtained to begin remedial planning activities at the site and, in 1984, the site was listed on U.S. EPA's NPL. Subsequently, the U.S. EPA Superfund monies were allocated to initiate remedial planning activities at the site.

The Remedial Investigation (RI) was conducted between the summer of 1983 and April 1988. The RI focused on the collection of data relevant to the evaluation of site environmental quality conditions, the assessments of public health and environmental risks, and the determination of the need for site remediation.

A combination notice letter and request for information was sent to potentially responsible parties on May 30, 1985.

III. Community Relations

Copies of the Feasibility Study (FS) were made available to the public for the Mid-State Landfill Disposal site on July 18, 1988. The Stratford Village Hall and the Marathon County Public Library, Stratford Branch are serving as repositories for this and all other documents relating to this site. The U.S. EPA issued a press release to the Stratford Journal, Abbotsford Record-Review, Marshfield News-Herald, Wausau Daily Herald, and other Wausau media announcing the dates of the public comment period and the public meeting.

A proposed plan was made available to the public on July 24, 1988. The public comment period was held from July 25, 1988 to August 23, 1988. The public hearing to discuss the proposed plan was held July 28, 1988, at the Stratford Community Hall. Approximately 35 residents, local officials, and media attended the meeting. Representatives of the U.S. EPA, WDNR and CH_2M Hill (EPA contractor) were also present.

The citizens took an active role in the meeting. Their main concern was declining property values and safe drinking water. Many residents urged U.S. EPA to purchase the property surrounding the site and to provide all residents near the site an alternate water supply; however, in the absence of a buy-out, the majority of the citizens support the recommended alternative.

During the RI/FS, other community relations activities included kick-off and up-date meetings, fact sheets, press releases and advertisements. A community relations plan was developed prior to the start of the RI. All documents relating to the project have been placed in the two repositories. U.S. EPA has also established an Administrative Record at the Marathon County Library, Stratford Branch, in conjunction with the repository.

IV. Scope and Role of Response Action

The selected alternative for the Mid-State site includes a soil/clay cap for the Old Mound area and the Interim Expansion area. The lagoon will also be capped and the lagoon sludge will be solidified as necessary to provide sufficient bearing capacity to support the cap. The cap will be in conformance with the State of Wisconsin sanitary landfill closure requirements. A new water supply will be provided to protect residents from future potential groundwater contamination. Leachate and ponded water collected from the existing collection system in the Interim Expansion area will be disposed of off-site. Because of the source control measure, future surface water collected is not expected to be contaminated and will be directed to the natural surface water drainage ways.

During the pre-design stage, a minimum of three deep bedrock wells will be installed to obtain additional information relating to groundwater vertical gradients. If a downward flow component exists, samples will be taken to determine the extent of contamination deeper in the aquifer. Also, off-site monitoring wells will be installed to gather water level information and additional data regarding off-site horizontal flow gradients. These wells will be included as a part of the long-term monitoring program.

This alternative will prevent direct contact with the landfills and lagoon, and will minimize leachate production so that the groundwater will gradually meet WDNR standards. The potential risk of cancer from ingestion of contaminated groundwater will be eliminated by furnishing near-by residents an alternate water supply.

V. Site Characterization

During active operation of the Mid-State Disposal site, the landfill accepted municipal, commercial, and industrial wastes. This included papermill sludge, asbestos dust, solvents, pesticides, paint sludges and metals. The major organic and inorganic contaminants of concern are 1,1-dichloroethene, trichloroethene, benzene, methylene chloride, tetrachloroethane, nickel, iron, and manganese. Table 1 presents a toxicity profile of these contaminants in addition to other chemicals associated with the site and their potential effects on humans and wildlife. Table 2 provides a list of specific contaminants found in the groundwater and their concentration levels.

Potential pathways for contaminant migration off-site include air, groundwater, and surface water. Currently, surface water and air quality have been shown not to be adversely affected by site contamination. However, deterioration in the condition of the existing caps and covers over the waste areas could result in migration via the air and surface water pathways.

Groundwater at the site has become contaminated by leachate percolating from the waste disposal areas down to the underlying aquifer. The evidence of th is the groundwater contamination detected under the Old Mound area. The rate of leachate percolation is limited by the amount of precipitation infiltrating at the ground surface, since the waste is above the water table. Potential future pathways of human health risk are shown in Figure 3.

There is evidence of ponded leachate that may be contributing to groundwater contamination. Many of the organic compounds detected at the site are very mobile and may be transported at nearly the same speed as the groundwater. The inorganic compounds have little mobility.

Leachate collection systems were installed in late 1979 and were designed to collect leachate from both the sludge lagoon and the Interim Expansion area of the site. According to the WDNR, the present system in the sludge lagoon consists of a crude peripheral network of pipes, placed 3 to 4 feet below the surface, which collected leachate from the upper part of the lagoon and drained into a common manhole. This system is currently not pumped. According to the WDNR, a simple french drain with two crushed rock legs in the fill area is located on the west side of the Interim Expansion area. This system drains into two separate manholes. Leachate from this system is disposed of weekly at the Weyerhaeuser wastewater treatment plant in Rothschild, Wisconsin, approximately 37 miles from the site.

Table 1 (Page 1 of 6)
TOXICITY PROFILES OF SELECTED CHEMICALS
MID-STATE DISPOSAL RI

Chemical	Acute Toxicity Summary*	Chronic Toxicity Summary*	Cancer Potential*	Other*
Asbestos	Little information available indicating acute toxicity.	No known chronic nonmalignant effects have been associated with the ingestion of asbestos in water. Inhalation exposure can result in asbestosis, a noncancerous respiratory disease that scars the lung tissues. Symptoms include shortness of breath and rales. Advanced asbestosis may produce cardiac failure and death.	Occupational exposure to humans via inhalation of asbestos fibers has been associated with increased incidence of lung cancer and mesothelioma (cancer of the thin membrane lining the chest and abdomen). There have been inconclusive studies to date indicating that ingestion of asbestos in water or food may result in increased cancer risk. An NTP study suggested possible evidence of carcinogenicity from ingestion of intermediate-range chrysotile fibers by male rats.	Synergistic interaction between smoking cigarettes and inhalation of asbestos fiber in the production of lung cancers.
Barium	Highly toxic when salts ingested (dose of barium chloride lethal to humans is 800 to 900 mg). Other effects include: increased blood pressure; prolonged muscular stimulation; gastroenteritis; hypokalemia; and cardiovascular effects such as ventricular fibrillation and extra systoles.	Prolonged occupational inhalation has resulted in baritosis--a benign, reversible pneumoconiosis. No strong determination of chronic effects from ingestion exposure. Possible increase in cardiovascular disease and hypertension.	--	Toxicity increases with solubility.
Benzene	Benzene is a central nervous system depressant at high concentration and may cause acute narcotic reactions. Ingestion of 9 to 12 g has been noted to cause staggering gait, vomiting, loss of consciousness, delirium, and death. Death has resulted from single 5 to 10-minute exposures to benzene in air at 20,000 ppm. Concentrations of 3,000 to 7,500 ppm may result in toxic signs within 1 hour. No effects reported after acute exposure to 25 ppm.	The most important effect resulting from chronic benzene exposure is its hematotoxicity, the targets being the cells of the bone marrow. At the early stages, leukopenia, anemia, or thrombocytopenia may be seen as well as any combination of these. The lowest air levels of benzene demonstrated to produce a decrease in human circulating blood cells are in the range of 40 to 50 ppm. The initial symptoms include fatigue, headache, nausea, and loss of appetite. Continued exposure results in severe bone marrow damage.	There is sufficient evidence that benzene is carcinogenic in animals and that benzene is carcinogenic in man. Occupational studies have established a relationship between benzene exposure (inhalation) and leukemia. Benzene is carcinogenic in rats by both the ingestion and inhalation routes.	A correlation between benzene exposure and chromosomal observations in bone marrow and lymphocytes of exposed individuals has also been observed. Retardation affected development accompanied by a decrease in material weight gain have been seen in reproduction toxicity studies.
Cadmium	Acute exposure symptoms of cadmium toxicity include nausea, vomiting, diarrhea, muscular cramps, and salivation. In severe intoxication, symptoms include sensory disturbances, liver injury, and convulsions. In fatal intoxications, those symptoms are followed by shock and/or renal failure and cardiopulmonary depression. Estimated acute human lethal dose is 350 to 35,000 mg for a 70-kg adult.	Chronic oral exposures can result in pain, osteomalacia, osteoporosis, proteinuria, glucosuria, and anemia. Kidneys tissue is the most sensitive to low level chronic exposure.	Lung and prostate cancer resulted from inhalation of cadmium by smelter workers. No evidence of carcinogenicity from chronic oral exposure.	Cadmium does not readily pass through the skin. The diet is the major source of human exposure to cadmium (34 ug/day). A nonessential element.

*Health effect or target organ may be based on animal studies and does not imply that the results of exposure to humans will be the same.

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Table 1 (Page 2 of 4)

Chemical	Acute Toxicity Summary[a]	Chronic Toxicity Summary[a]	Cancer Potential	Other
Chromium	Inhalation of chromate salts results in irritation and inflammation of nasal mucosa, ulceration, and perforation of nasal septum. Doses of 0.5 to 1.5 g of $K_2Cr_2O_7$ have been fatal in humans. Contact with chromic acid or chromate salts have resulted in ulcers and contact-type dermatitis. Overall, hexavalent forms are more toxic than trivalent forms.	Chronic exposure to hexavalent chromium has resulted in kidney damage in animals and humans. The liver is sensitive to chromium but less so than kidneys or lungs. Effects may include tubular necrosis of the kidneys. Inhalation exposures to chromates in industrial settings have resulted in nasal membrane inflammation, chronic rhinitis, laryngitis, and pharyngitis. Exposures to skin can result in contact dermatitis in sensitive individuals. Overall, hexavalent forms are more toxic than trivalent forms.	Excess lung cancer associated with chromate-producing industry workers. Carcinogenic effects observed only in lungs. No evidence of carcinogenic potential via oral exposure. Chromate salts carcinogenic in rats by inhalation.	Essential element. Toxicity related to valence state. Genotoxic in in vivo and in vitro studies due to DNA binding.
Copper	Exposure (inhalation) to copper dusts results in symptoms similar to metal fume fever. Exposure to metal fumes results in upper respiratory tract irritation, metallic or sweet taste, nausea, metal fume fever, and skin and hair discoloration. Exposure to dusts and mists of copper salts results in congestion of nasal mucous membranes, sometimes of pharynx, and occasional ulceration with perforation of nasal septum. Acute copper sulfate poisoning in humans (1 to 12 g of copper sulfate) is sometimes fatal and includes vomiting, diarrhea, and renal injury.	Available evidence does not support chronic toxicity in normal human beings attributable to long-term intake of low (≤1 mg) concentrations of copper by oral intake. In susceptible individuals, Wilsons disease (disorder of copper metabolism) typifies chronic copper poisoning with hepatic cirrhosis, brain damage, demyelination, kidney defects, and copper deposition in the cornea. Chronic exposures in animals result in injury to liver, kidneys, and spleen. Copper is a gastrointestinal tract irritant.	--	Essential nutrient. Organoleptic threshold in water between 1 to 5 mg/l.
1,1-Dichloroethane	Causes CNS depression when inhaled at high concentrations. Oral LD_{50} for rats is 725 mg/kg, but other experiments in this dose range produced no effects. Inhalation produces anesthesia.	Relatively low capacity to cause liver or kidney injury even, after repeated exposure. No human exposure data.	--	Limited toxicity testing, but one of the least toxic of the chlorinated ethanes.
Ethylbenzene	Ethylbenzene is a skin irritant and its vapor is irritating to the eyes at a concentration of 200 ppm. Acute toxicity data on oral and dermal routes in both rats and rabbits indicate a low toxicity for ethylbenzene. An oral LD_{50} value in rats of 3,500 mg/kg is reported.	Inhalation exposures at 600 ppm resulted in slight changes in liver and kidney weights in rats and guinea pigs, slight changes in liver weight in monkeys, and histopathological changes in the tests of monkeys and rabbits. High-dose feeding studies in rats resulted in liver and kidney effects. Ethylbenzene is not known to be toxic to the liver or kidneys of humans.	--	Some evidence of reproductive effects on animals.
Lead	Acute lead intoxication in humans characterized by encephalopathy, abdominal pain, hemolysis, liver damage, renal tubular necrosis, seizures, coma, and cardiorespiratory arrest. Severe poisoning of this sort is rare.	Chronic low levels of exposure to lead affect the hematopoietic system, the nervous system, and the cardiovascular system. Lead inhibits several key enzymes involved in heme biosynthesis. One characteristic effect of chronic lead intoxication is anemia, which is exhibited by reduced hemoglobin production and shortened erythrocyte survival. Animal studies indicate that lead inhibits nervous system development. In humans, lead exposure has resulted in nervous system injury, including reduced hand-eye coordination, reaction time, visual motor performance, and nerve conduction velocity. The developing child appears especially sensitive to lead-induced nervous system injury. Epidemiological studies have indicated that chronic lead exposure may be associated with increased blood pressure in humans.	Lead salts have some evidence of carcinogenicity in animals.	Children are especially sensitive to low level-effects.

[a]Health effect or target organ may be based on animal studies and does not imply that the levels of exposure to humans will be the same.

Table 1 (Page 3 of 4)

Chemical	Acute Toxicity Summary[a]	Chronic Toxicity Summary[a]	Cancer Potential	Other
Manganese	Manganese has a very low order of acute oral toxicity. Rats are affected at 2,000 ppm in the diet. Acute inhalation exposures to very high concentrations can cause manganese pneumonitis, increased susceptibility to respiratory disease, and pathologic changes, including epithelial necrosis and bronchiolar proliferation.	Chronic manganese poisoning results from inhalation of high concentrations of manganese dust. Chronic manganese poisoning is characterized by progressive deterioration of the central nervous system. Chronic effects of manganese poisoning are similar to those of Parkinson's disease. Liver changes are also frequently seen. Individuals with an iron deficiency may be more susceptible to chronic poisoning. Chronic toxicity from drinking water has not been reported.	--	Manganese is an essential nutrient. Manganese concentrations in water above 50 ug/l may exhibit undesirable taste and discoloration.
Nickel	Nickel and nickel salts have relatively low acute toxicity in various species of animals when administered orally. Major signs of acute nickel toxicity consist of hyperglycemia and gastrointestinal and central nervous system effects. Acute exposures to nickel-containing dust may result in chemical pneumonitis.	Animal studies indicate that nickel has low chronic oral toxicity. Rhinitis, nasal sinusitis, and nasal mucosal injury are among the effects reported among workers chronically exposed to various nickel compounds. Dermatitis and other dermatological effects are the most frequent effects of exposure (dermal) to nickel and nickel-containing compounds. These are usually the result of industrial exposures or exposures to nickel-containing alloys in commercial products such as jewelry.	There is extensive epidemiological evidence indicating excess cancer of the lung and nasal cavity for workers of nickel refineries and smelters, and weaker evidence in workers at nickel electroplating and polishing operations. Nickel compounds implicated as having carcinogenic potential include insoluble dusts of nickel subsulfide and nickel oxides, vapor of nickel carbonate and soluble aerosols of nickel sulfate and nickel carbonate. There is no evidence that nickel compounds are carcinogenic in animals after oral exposure.	Some forms are mutagenic. May or may not be an essential element.
Tetrachloroethene	Short-term inhalation exposure in humans can result in depression of the central nervous system characterized by dizziness, impaired memory, confusion, irritability, "inebriation-like" symptoms, tremors, and numbness. Kidney impairment, hepatitis, and enlargement of the spleen and liver have been reported.	Very little data are available concerning long-term exposure to PCE. Hepatotoxic effects have been documented for long-term inhalation exposures to workers as have hepatitis, cirrhosis, liver-cell necrosis, enlarged liver, and kidney disease. Oral exposures in experimental animals resulted in minor liver impacts in rats but more significant effects in mice.	Found to produce liver cancer in mice. Inhalation studies with rats have yielded evidence of carcinogenicity (leukemia). No epidemiological studies conclusively linking human exposure to carcinogenicity.	Animal studies suggest potential teratogenic and embryotoxic effects.
Toluene	Animal studies indicate the main toxic effect of acute inhalation is upon the central nervous system. Toluene-induced hearing loss in rats after short-term, high-level inhalation exposure. No human reports of acute ingestion. Primary hazard associated with acute inhalation exposure to high levels of toluene is central nervous system depression. Produces euphorical inebriation-like symptoms. Long-term abuse of toluene has resulted in emotional and intellectual disturbances as well as CNS impairment.	Long-term ingestion studies in various animal species resulted in no adverse effects. In general, there are limited data on oral exposures. Long-term human exposure to vapors 80 to 160 ppm produced no changes in blood or liver in workers.	No evidence of carcinogenicity.	Embryotoxic in animals, possible animal teratogen.

[a]Health effect or target organ may be based on animal studies and does not imply that the results of exposure to humans will be the same.

Table 1 (Page 4 of 4)

Chemical	Acute Toxicity Summary[a]	Chronic Toxicity Summary[a]	Cancer Potential	Other
Trichloroethene	Manifestation of TCE exposure is depression of the CNS, which is demonstrated by dizziness, headache, visual disturbances, incoordination similar to that induced by alcohol, sleepiness, tremors, nausea, and vomiting. Cardiac arrhythmias and death from ventricular fibrillation and cardiac arrest due to acute exposure above 15,000 ppm. Accidental ingestion of about 150 ml resulted in acute kidney failure, coma, and liver and cardiovascular damage. Local exposure to TCE vapors may cause irritation to eyes, nose, and throat.	Prolonged occupational exposures to vapors (200 to 400 ppm) resulted in CNS symptoms including headache, dizziness, nausea, tremors, sleepiness, fatigue, and vomiting. These were reversible. Lower human exposures (100 to 200 ppm) resulted in biochemical changes in liver function. In test animals, chronic exposure to TCE induces low to moderate liver and kidney toxicity. Prolonged inhalation exposures to test animals at levels greater than 2,000 mg/m^3 resulted in renal toxicity, hepatotoxicity, and neurotoxicity.	Has produced increases in heptocellular carcinomas in mice after oral administration. Other tests with mice and rats have produced negative results.	Possibly mutagenic.
Vinyl Chloride	Acute occupational exposure to high concentrations of vinyl chloride can produce symptoms of narcosis in humans. Respiratory tract irritation, bronchitis, headache, irritability, memory disturbances, and tingling sensations may also occur.	Human health effects associated with chronic exposure to vinyl chloride include hepatitis-like liver changes, decreased blood platelets, enlarged spleens, decreased pulmonary function, acroosteolysis, sclerotic syndrome, and thrombocytopenia.	Vinyl chloride is a known human carcinogen, causing liver angiosarcomas and tumors of the brain, lung, and hemolymphopoietic system in humans. Vinyl chloride is a carcinogen in mice, rats, and hamsters. Adenomas and adenocarcinomonas of the lung, angiosarcomas of the liver, and lymphomas and neuroblastomas of the brain have been induced in laboratory animals by inhalation.	Vinyl chloride is mutagenic in several test systems. Chromosome aberrations have been reported in exposed workers. In humans, possible relationships between exposure and birth defects and fetal death. No animal evidence for teratogenic effects.
Xylene	Short-term inhalation exposures are associated with narcotic effects on the central nervous system; variable effects on the liver and kidney; and irritant effects on the gastrointestinal tract.	Data on the effects of long-term human exposure to xylene are primarily high-level occupational inhalation exposures that have resulted in CNS effects, incoordination, nausea, vomiting, and abdominal pain. Ingestion data are almost completely lacking. Studies with laboratory animals suggest xylene has a relatively low chronic toxicity.	No evidence of carcinogenicity.	--

[a]Health effect or target organ may be based on animal studies and does not imply that the results of exposure to humans will be the same.

Table 2

SUMMARY OF COMPARISON OF MONITORING WELL DATA EXCEEDING STANDARDS TO U.S. EPA STANDARDS, CRITERIA, AND GUIDELINES
MID-STATE DISPOSAL RI

Chemical	Maximum Detected Groundwater Concentration	Well	Maximum Contaminant Levels[a]			Ambient Water Quality Criteria for Drinking Water[b]		Office of Drinking Water Health Advisories[c]				
			Primary MCL	Secondary MCL	MCLG	Toxicity Protection	1×10^{-6} Excess Cancer Risk	One-day 10-kg Child	Ten-day 10-kg Child	Longer Term 10-kg Child	Longer Term 70-kg Adult	Lifetime 70-kg Adult
1,1-Dichloroethene	50	MW-1	7	-	7	-	0.33	2,000	1,000	1,000	3,500	370
	1	MW-20D										
Benzene[d]	5	MW-1	5	-	0	-	0.67	235	235	-	-	-
	3	MW-21D										
Tetrachloroethene	5.8	MW-1	-	-	0[f]	-	0.17	2,000	2,000	1,400	5,000	10
	5.4	MW-10										
	2.0	MW-20D										
	2.0	MW-21D										
Trichloroethene	8.7	MW-1	5	-	0	-	2.8	-	-	-	-	260
	2.4	MW-10										
	1	MW-20D										
	7	MW-21D										
Vinyl chloride	1	MW-20D	2	-	0	-	2.0	2,600	2,600	13	46	-
	1	MW-21D										
Methylene chloride	90	MW-1	-	-	-	-	5.0	13,000	1,500	-	-	-
	25	MW-21D										
Nickel	43	MW-1	-	-	-	15.4	-	1,000	1,000	100	350	150
	7.7	MW-3										
	7.3	MW-5										
	5.1	MW-6										
	24	MW-7										
	20	MW-8										
	66	MW-9										
	40	MW-10										
	7.4	MW-11										
	5.8	MW-12										
	6.9	MW-13										
	48	MW-15										
	84	MW-20D										

Note: All concentrations in µg/l.

[a] Final MCLs and MCLGs published in 40 CFR 141 and 52 FR 25690-25717. Proposed MCLs and MCLGs published in 50 FR 46936-47022.

[b] U.S. EPA, Quality Criteria for Water, 1986, EPA 440/5-86-001, May 1, 1986.

[c] U.S. EPA, Health Advisories for Legionella and Seven Inorganics, March, 1987, NTIS PB87-235586; Health Advisories for 25 Organics, March 1987, NTIS PB87-235578; Health Advisories for 16 Pesticides, March 1987, NTIS PB-200176.

[d] Background concentration of benzene is 3 µg/l.

[e] Background concentration of iron is 1,166 µg/l.

[f] Proposed MCLG

- No criteria available

Table 2
(Continued)

Chemical	Maximum Detected Groundwater Concentration	Well	Maximum Contaminant Levels[a]			Ambient Water Quality Criteria for Drinking Water[b]		Office of Drinking Water Health Advisories[c]				
			Primary MCL	Secondary MCL	MCLG	Toxicity Protection	1×10^{-6} Excess Cancer Risk	One-day 10-kg Child	Ten-day 10-kg Child	Longer Term 10-kg Child	Longer Term 70-kg Adult	Lifetime 70-kg Adult
Cadmium	9.0	MW-1	10	-	5[f]	10	-	43	43	5	18	5
	7.2	MW-3										
	7.2	MW-6										
	7.2	MW-8										
	5.4	MW-13										
	7.2	MW-15										
Iron[e]	1,020	MW-3	-	300	-	-	-	-	-	-	-	-
	2,650	MW-5										
	302	MW-6										
	18,400	MW-7										
	12,200	MW-9										
	435	MW-11										
	551	MW-13										
	2,030	MW-14										
	1,120	MW-15										
	1,622	MW-21D										
Manganese	616	MW-1	-	50	-	-	-	-	-	-	-	-
	602	MW-3										
	275	MW-5										
	63	MW-6										
	7,520	MW-7										
	51	MW-8										
	17,200	MW-9										
	981	MW-10										
	146	MW-11										
	325	MW-12										
	120	MW-13										
	309	MW-14										
	830	MW-15										
	498	MW-20D										
	277	MW-21D										

Note: All concentrations in µg/l.
[a] Final MCLs and MCLGs published in 40 CFR 141 and 52 FR 25690-25717. Proposed MCLs and MCLGs published in 50 FR 46936-47022.
[b] U.S. EPA, Quality Criteria for Water, 1986, EPA 440/5-86-001, May 1, 1986.
[c] U.S. EPA, Health Advisories for Legionella and Seven Inorganics, March, 1987, NTIS PB87-235586; Health Advisories for 25 Organics, March 1987, NTIS PB87-235578; Health Advisories for 16 Pesticides, March 1987, NTIS PB-200176.
[d] Background concentration of benzene is 3 µg/l.
[e] Background concentration of iron is 1,166 µg/l.
[f] Proposed MCLG
- No criteria available

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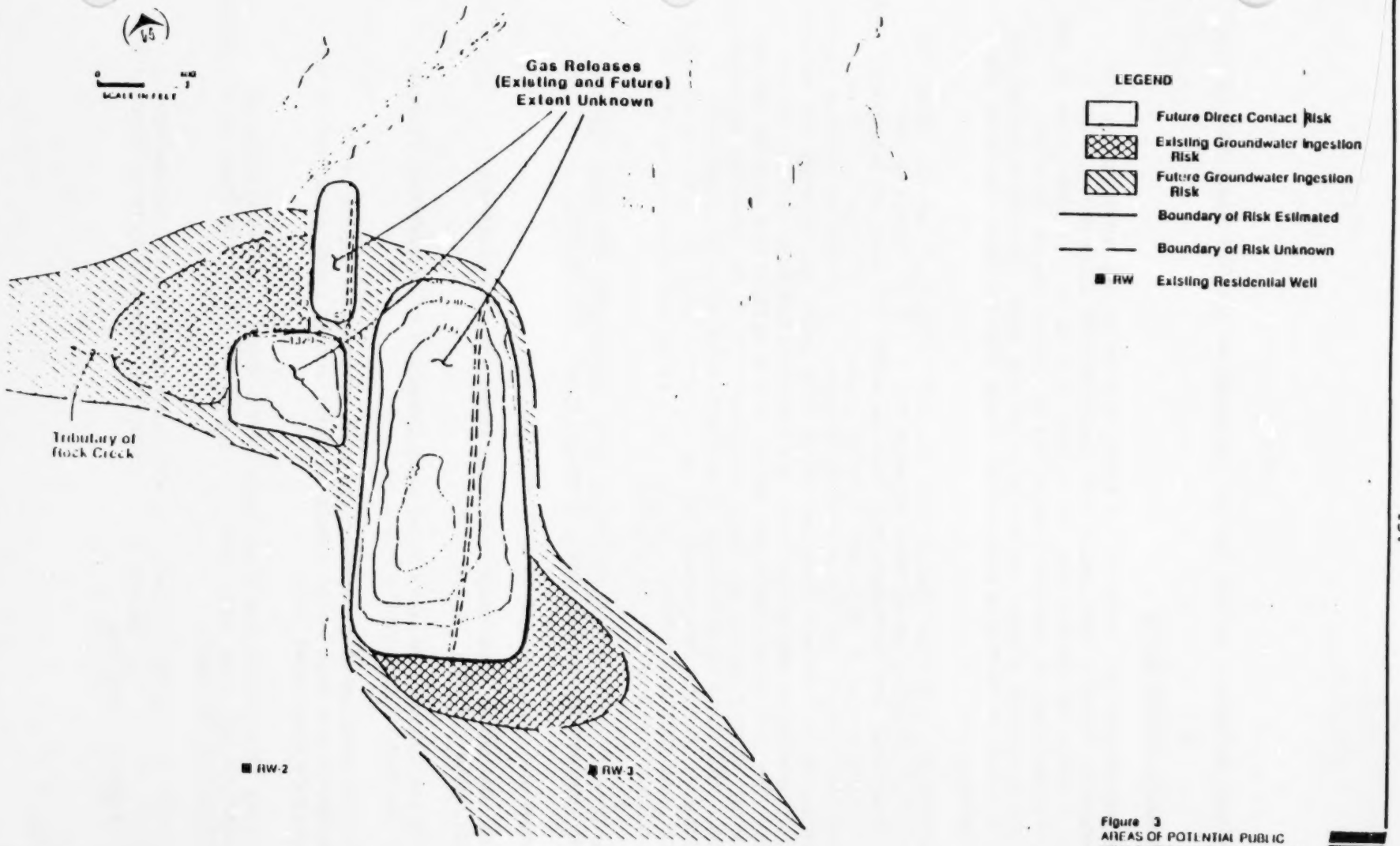

Figure 3
AREAS OF POTENTIAL PUBLIC HEALTH RISK UNDER NO ACTION
Moj State Disposal FS

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A leachate collection system was not installed at the Old Mound area of the site.

V. Summary of Site Risks

A risk assessment was conducted to assess the potential human health and environmental effects associated with the no-action alternative. The no-action alternative assumes that no corrective actions will take place at the site and there are no restrictions placed on future use of the site. The risk assessment showed contamination on the site. No contamination was found off-site at levels posing a significant risk to human health or the environment.

The assessment indicates that primary Maximum Contaminant Levels (MCLs) for ingestion of drinking water were exceeded for 1,1-dichloroethene and trichloroethene, and secondary MCLs were exceeded for iron and manganese. The water quality criteria (WQC) for toxicity protection of aquatic life was exceeded for nickel; the WQC for drinking water for protection against cancer exceeding the 10^{-6} excess lifetime cancer risk level was exceeded for benzene, 1,1-dichloroethene, methylene chloride, tetrachloroethane, and trichloroethene. The 10^{-6} level means one person in one million may develop cancer. The 10-day chronic health advisory for protection of children was exceeded for cadmium. The State of Wisconsin enforcement standards for groundwater (Groundwater Quality Regulations NR 140) were exceeded for iron, manganese, benzene, and trichloroethene. Again, these risks presently are limited to areas within the boundary of the site.

Future potential exposures associated with groundwater ingestion are the primary concern at the Mid-State Disposal site. See Table-2.

Site specific concerns are as follows:

Lifetime cancer risk associated with ingestion of groundwater flowing to the west is 2×10^{-6}.

Lifetime cancer risk associated with ingestion of groundwater flowing to the south/southeast is 1.5×10^{-3}.

On-site groundwater flowing to the west contains manganese at concentrations that would result in daily intake rates in excess of the reference dose level (RFD).

On-site groundwater has known carcinogens which includes benzene at concentrations that equal the primary MCL and exceed the State of Wisconsin enforcement standard.

On-site groundwater contains 1,1-dichloroethene and trichoroethene in concentrations that exceed their respective MCLs and State of Wisconsin enforcement standards.

Other site specific concerns include:

Landfill gas contains vinyl chloride and other organic compounds.

Surface seeps from both landfills are associated with areas of erosion.

Erosion of landfill covers promotes direct contact with waste and increased precipitation/infiltration.

The excess lifetime cancer risk to humans from ingestion of groundwater to the west and south/southeast was calculated very conservatively, based on summing the individual chemical risk for the maximum concentration found in these areas. The risk to the south is based mainly on a one-time high detection of 1,1-dichloroethene. (Table 3 and Table 4.)

The potential risk exists for: 1. future migration of contaminated groundwater to off-site users; 2. future leachate run-off to nearby waterways resulting in environmental degradation and detrimental impacts on aquatic life; and, 3. exposure to contaminated groundwater by ingestion and direct contact through future development of the site.

VII. Description of Alternatives

The assembled remedial action alternatives represent a range of possible remedies evaluated across the board against a given set of criteria. Figure 4 illustrates the major components of the assembled alternatives. The selected alternative will undergo further refinement during the final pre-design and design phases. The extent of the refinements or modifications will be determined by the results of additional sampling and treatability studies. This will be examined in detail in the discussion on the selected alternative in this section.

All the alternatives, except the no-action alternative, incorporate the following features:

- Pre-design activities will include the installation of a minimum of three deep bedrock wells to obtain information about the groundwater vertical gradients; seven shallow wells will be installed to gain additional information on horizontal flow gradients and migration of contaminants; samples from residential wells will be taken and their depth to casing will be determined; and the sludge will sampled for permeability and hazardous constituent contamination. The extent of the activities will depend on the technologies identified in the alternative.

- Institutional controls, as needed, will be placed on the site property to control soil excavation and on-site well installation. Existing WDNR regulations will be used to control off-site well installation within 1200 feet of the landfill. The timing and extent of institutional controls will be determined in the design phase of the remedial action.

Table 3
EXCESS LIFETIME CANCER RISK DRINKING WATER INGESTION
MID-STATE DISPOSAL RI

Chemical	Carcinogen Classification	U.S. EPA Cancer Potency Factor kg-day/mg	Flow to West[a] Median Reported Concentration µg/l	Flow to West[a] Maximum Reported Concentration µg/l	Flow to West[a] Excess[c] Lifetime Cancer Risk	Flow to South[b] Median Reported Concentration µg/l	Flow to South[b] Maximum Reported Concentration µg/l	Flow to South[b] Excess[c] Lifetime Cancer Risk
Benzene	A	5.2×10^{-2}	-	-	-	ND	5	7.4×10^{-6}
Bis(2-ethylhexyl)phthalate	B2	6.84×10^{-4}	ND	124	2.4×10^{-6}	ND	90	1.8×10^{-6}
1,1-Dichloroethene[d]	B2	5.8×10^{-1}	-	-	-	ND	50	1.5×10^{-3}
Methylene chloride	B2	7.5×10^{-3}	-	-	-	*	90	1.9×10^{-5}
Tetrachloroethene	B2	5.1×10^{-2}	-	-	-	5	5.8	8.5×10^{-6}
Trichloroethene	B2	1.1×10^{-2}	-	-	-	2.5	8.7	2.7×10^{-6}
Sum					2.4×10^{-6}			1.5×10^{-3}

*Cannot be determined because of blank contamination.
ND - Nondetectable

[a] Includes data from monitoring wells MW-5, MW-6, MW-7, MW-8, and MW-9.

[b] Includes data from monitoring wells MW-1, MW-3, and MW-10.

[c] Based on maximum reported concentrations. Lifetime average drinking water intake is assumed to be 2 l/day; body weight is assumed to be 70 kg.

[d] 1,1-Dichloroethene was detected in one monitoring well sample only.

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Table 4
COMPARISON OF DAILY INTAKE TO REFERENCE DOSE[a]
DRINKING WATER INGESTION
MID-STATE DISPOSAL RI

Chemical	Reference Dose mg/kg/day	Flow to West[d] Median Reported Concentration (µg/l)	Maximum Reported Concentration (µg/l)	Estimated Daily Intake[c] (DI) mg/kg/day	DI/RfD	DI Exceeds RfD?	Flow to South[e] Median Reported Concentration (µg/l)	Maximum Reported Concentration (µg/l)	Estimated Daily Intake[c] (DI) mg/kg/day	DI/RfD	DI Exceeds RfD?
Barium	5.1×10^{-2}	64	456	1.3×10^{-2}	0.26	No	58	100	2.9×10^{-3}	0.06	No
Bis(2-ethylhexyl) phthalate	2×10^{-2}	ND	114	4.0×10^{-3}	0.20	No	ND	No	Neg.	Neg.	No
Cadmium	2.9×10^{-4}	ND	7.2	2.1×10^{-4}	0.72	No	ND	9	2.6×10^{-4}	0.90	No
Chromium (+3)[b]	3.0×10^{0}	ND	11	3.2×10^{-4}	Neg.	No	ND	6	1.7×10^{-4}	Neg.	No
Chromium (+6)[b]	5.0×10^{-3}	ND	11	3.2×10^{-4}	0.06	No	ND	6	1.7×10^{-4}	0.03	No
Copper	3.7×10^{-2}	*	ND	Neg.	Neg.	No	ND	10	2.9×10^{-4}	Neg.	No
Di-n-butyl phthalate	1.0×10^{-1}	ND	ND	Neg.	Neg.	No	ND	10	2.9×10^{-4}	Neg.	No
1,1-Dichloro-ethane	1.0×10^{-1}	ND	ND	Neg.	Neg.	No	ND	10	2.9×10^{-4}	Neg.	No
1,1-Dichloro-ethene	9.0×10^{-3}	ND	ND	Neg.	Neg.	No	ND	50	1.5×10^{-3}	0.7	No
Lead	1.4×10^{-3}	*	4	1.4×10^{-4}	0.10	No	*	ND	Neg.	Neg.	No
Manganese	1.1×10^{-1}	61	17,000	4.9×10^{-1}	2.23	Yes	602	918	3.0×10^{-2}	0.14	No
Methylene chloride	6.0×10^{-2}	*	ND	Neg.	Neg.	No	*	90	2.6×10^{-3}	0.04	No
Nickel	2.0×10^{-2}	5.3	66	1.9×10^{-3}	0.09	No	7.7	40	1.2×10^{-3}	0.06	No
Phenol	6.0×10^{-1}	ND	25	7.8×10^{-3}	0.01	No	ND	114	3.3×10^{-3}	0.00	No
Tetrachloro-ethene	1.0×10^{-2}	ND	Neg.	Neg.	Neg.	No	5	5.6	1.6×10^{-4}	Neg.	No
Vanadium	7.0×10^{-3}	ND	-	2.0×10^{-4}	Neg.	No	ND	7.1	2.0×10^{-4}	Neg.	No
Zinc	2.1×10^{-1}	*	36	1.7×10^{-3}	0.01	No	*	61	1.8×10^{-3}	Neg.	No
Hazard Index (Sum of DI/RfD)					3.8					1.5	

[a] Lifetime average drinking water intake is assumed to be 2 l/day; body weight is assumed to be 70 kg.

[b] Maximum reported concentration reported is for total chromium concentration.

[c] Based on maximum reported concentration.

[d] Includes data from monitoring well MW-5, MW-6, MW-7, MW-8, and MW-9.

[e] Includes data from monitoring wells MW-1, MW-3, and MW-10.

ND = 50% or more of samples had Non-detectable concentrations of the constituent.
* = Cannot be determined because of substantial contamination of samples.
Neg. = Negligible.

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COMPONENTS	ALTERNATIVES 1	2	3	4	5	6	7
LANDFILL CONTENTS							
Repair Existing Cap		●	●	●			
Soil/Clay Cap					●	●	
Multilayer Cap							●
Surface Water Controls		●	●	●	●	●	●
LAGOON WASTES							
Insitu Solidification	NO			●	●	●	●
Lagoon Cap				●	●	●	●
GROUNDWATER							
Alternate Water Supply	ACTION	●	●	●	●	●	●
Extraction			●	●		●	●
Onsite Treatment			●	●		●	●
Offsite Discharge to Surface Water			●	●		●	●
PONDED LEACHATE AND INTERIM EXPANSION AREA LEACHATE							
Control/ Collection Onsite Treatment, Offsite Discharge to Surface Water			●	●		●	●
Control/Collection Offsite Treatment		●			●		
SITE-WIDE COMPONENTS							
Predesign Investigations		●	●	●	●	●	●
Monitoring	*	●	●	●	●	●	●
Fence	●	●	●	●	●	●	●
Institutional Controls		●	●	●	●	●	●
Road Work		●	●	●	●	●	●
Present Worth ($1000)	180	3,400	7,500	12,000	16,000	19,000	22,000

* *Includes monitoring of two residential wells.*

Figure 4
PRESENT WORTH COST OF ASSEMBLED ALTERNATIVES
Mid-State Disposal FS

- Up to 236,000 gallons of ponded surface water consisting of leachate diluted with precipitation will be collected and treated during the first year. For those alternatives without an on-site treatment system, vacuum trucks will be used to collect the leachate and dispose of it off-site to a POTW or industrial treatment facility. For the alternatives with an on-site treatment system, the leachate will be collected and transferred to the treatment facility by a series of hoses and pumps.

- The Interim Expansion area leachate collection system will continue to operate and approximately 5,000 to 10,000 gallons of leachate per week will be treated on-site or taken off-site to a POTW or an industrial treatment facility depending on the alternative. Leachate collection will continue for as long as the groundwater is extracted or until leachate is no longer generated.

- It will be necessary to reconstruct as much as 800 feet of road near the sludge lagoon.

- Fencing will be installed around the perimeter of the site to restrict public access. Signs warning of the presence and potential danger of hazardous materials will be posted on the fence to further discourage unauthorized access to the site. The fence for the no-action alternative encompasses only the areas of contamination; the fence included in the final remedial action encompasses the areas of proposed activities.

- Regular monitoring of groundwater, surface water, and landfill gas will be considered as a part of all the alternatives except the no-action alternative. Seven new groundwater monitoring wells will be installed off-site, and ten landfill gas monitoring wells will be installed around the perimeter of the site to monitor sub-surface gas migration. Data from new and existing wells and from surface water will be used to monitor the remedial action.

ALTERNATIVE 1 - NO-ACTION

The no-action alternative provides a baseline for comparing the alternatives. The risk assessment shows that the greatest risk under the no-action alternative is by exposure either through further migration of the contaminated groundwater to the southeast and west, or through future development of the site or properties to the west of the site. To offer some protection to the public, the no-action alternative includes a fence and an additional round of residential well sampling.

Alternative 1 does not meet any State or Federal ARARs. See Table 5.

ALTERNATIVE 2 - ALTERNATIVE WATER SUPPLY, REPAIR CAP

Alternative 2 consists of repairing and maintaining the existing landfill

Table-5

COMPLIANCE WITH ARARS EVALUATION OF FINAL ALTERNATIVES[a]
MID-STATE DISPOSAL FS

Criteria	Alternative 1 No Action	Alternative 2 Alternate Water Supply, Repair Cap	Alternative 3 Groundwater Remediation, Repair Cap	Alternative 4 Sludge Solidification, Groundwater Remediation, Repair Cap	Alternative 5 Soil/Clay Cap, Sludge Solidification, Alternate Water Supply	Alternative 6 Soil/Clay Cap, Sludge Solidification, and Groundwater Remediation	Alternative 7 Multilayer Cap, Sludge Solidification, and Groundwater Remediation
mical-ecific ARARs.	Does not meet groundwater ARARs for drinking water.	May not meet groundwater protection ARARs at the site boundary. Monitoring and alternate water supply would make sure ARARs are not exceeded in the drinking water of the residents.	Would clean the groundwater to drinking water standards at the site boundary. The effluent would meet surface water quality discharge limits.	See Alternative 3.	Would eventually meet groundwater protection ARARs at the site boundary through natural attenuation. Until then, monitoring and alternate water supply ensure ARARs are not exceeded in drinking water.	See Alternative 3.	See Alternative 3.
cation-specific RARs.	Not applicable. There are no location-specific ARARs for this site.	See Alternative 1	See Alternative 1.	See Alternative 1.	See Alternative 1.	See Alternative 1.	See Alternative 1.
tion-specific RARs.	Not applicable since there is no action.	Would meet action-specific ARARs for monitoring. Would not meet state ARARs for cap construction.	Would meet action-specific ARARs for groundwater treatment systems and monitoring. Would not meet state ARARs for cap construction.	See Alternative 3.	Meets the state regulations concerning construction of a solid waste site cap.	Would meet groundwater treatment, monitoring, and cap construction ARARs.	See Alternative 6.
ther criteria d guidelines.	Allows ingestion of groundwater exceeding a 10^{-6} cancer risk level.	Provides protection against drinking groundwater that exceeds a 10^{-6} cancer risk level.	See Alternative 2.	See Alternative 2.	See Alternative 2.	See Alternative 2.	See Alternative 2.

[a] Alternatives 2 through 7 contain an alternate water supply, monitoring, and fencing.

caps, regrading the lagoon cover, and installing new wells in uncontaminated areas for potentially affected residents. The leachate collection system in the Interim Expansion Area would be continually pumped and the leachate would be treated off-site at a POTW or industrial wastewater treatment facility. Surface water run-off from the landfills would be directed off-site. Leachate surface seeps would be collected by a separate drainage system and treated off-site with other collected leachate. Landfill gas monitoring wells would be installed near the perimeter of the site.

In this alternative, the landfills and lagoon are covered to prevent direct contact, to deter further contamination of groundwater, and to prevent leachate from contaminating the off-site surface water to levels which exceed chronic Federal Water Quality Criteria for the protection of aquatic organisms. In addition, this alternative will prevent ingestion of contaminated groundwater which exceeds WDNR health standards or poses a potential risk of cancer in excess of 10^{-6}.

Pre-design activities for this alternative would include the development of a work plan, landfill gas sampling and air quality modeling, along with the additional investigations previously mentioned.

Alternative 2 does not meet WDNR solid waste regulation ARARs for cap construction. See Table 5.

ALTERNATIVE 3 - GROUNDWATER REMEDIATION, REPAIR CAP

This alternative includes groundwater extraction and treatment in addition to an alternative water supply. The extraction rate is estimated to be 100 gpm, which is based on 9 gpm from each of eleven extraction wells. The treatment system would consist of aeration and filtration. This alternative also includes repairing the existing caps through some minor grading and filling, as well as constructing surface water collection trenches. No additional source control actions would be implemented with this alternative. The existing leachate collection system would be pumped and the leachate taken to the on-site treatment system. The groundwater extraction and treatment systems will need to operate for as long as the landfills remain a threat to the environment and public health, which is estimated at more than 30 years. Since seepage of leachate may continue in the future, existing ponded leachate, future leachate, and surface water collected from the site will be treated in the on-site treatment system. It has been assumed that this flow will be small compared to the groundwater flow and, therefore, will have little hydraulic effect on the treatment system.

This alternative would: 1. provide new covers on the landfills and lagoon to prevent direct contact, 2. protect against ingestion of contaminated groundwater, and 3. protect against further off-site migration of contaminated groundwater.

Pre-design activities would include work plan development, landfill gas sampling and air quality modeling, groundwater treatability studies, and aquifer testing including the further investigations previously mentioned.

Alternative 3 does not meet WDNR solid waste regulation ARARs for cap construction. See Table 5.

ALTERNATIVE 4 - SLUDGE SOLIDIFICATION, GROUNDWATER REMEDIATION, REPAIR CAP

Alternative 4 incorporates the groundwater extraction and treatment system of Alternative 3 and in addition, provides for solidification of the sludge in the lagoon. This would be determined during pre-design. Solidification may be necessary to provide bearing capacity for the cover. Several engineering technologies may be explored for stabilization of the lagoon sludge. Stabilization will occur only as an engineering requirement if necessary to support the cap. A new soil/clay cap will be constructed in either event that will fulfill federal and state landfill cap requirements.

Ponded leachate would be treated in the on-site groundwater system and repair/grading and revegetation of the current landfill caps would be done to control erosion and minimize further ponding of surface water.

A monitoring program would be designed to provide information for the design and operation of the extraction systems. Operation and maintenance of this alternative would be required for as long as the landfills remain a hazard to public health and the environment. The goals of this alternative are: 1. provide cover for the landfills; 2. prevent direct contact; 3. increase the bearing capacity of the sludge if necessary so a soil/clay cap could be installed; 4. mitigate further groundwater contamination, which would reduce off-site migration of contaminated groundwater, and 5. prevent leachate from contaminating the off-site surface water.

Alternative 4 also includes pre-design activities, such as developing a work plan, landfill gas sampling, air modeling, groundwater and sludge treatability testing, aquifer testing, and further investigations.

Alternative 4 does not meet WDNR solid waste regulations.

ALTERNATIVE 5 - SOIL/CLAY CAPS, SLUDGE SOLIDIFICATION, AND ALTERNATIVE WATER SUPPLY

Alternative 5 includes a new soil/clay cap over the Old Mound and Interim Expansion Landfills. This alternative also includes a new cap over the sludge lagoon and solidification/stabilization of the sludge, if necessary, as described in Alternative 4. An alternate water supply, as well as institutional controls and monitoring of groundwater, will be included.

Within a year after installing the cap and solidifying the sludge lagoon, leachate production is expected to decrease significantly. Residents will be protected from potentially contaminated groundwater by new water supply wells. (New users would be protected by institutional controls, groundwater

monitoring, and connection into the alternate water supply.) Because there would be no off-site migration control, there may be some degree of future risk from drinking water off-site. However, the RI showed no off-site contamination in the shallow portion of the aquifer and the risk from contaminated groundwater on-site was estimated to be quite low. In addition, natural attenuation is anticipated to reduce contaminant levels since continued leachate production would be curtailed as a result of the caps. Ponded leachate, and leachate collected in the Interim Expansion area would be taken off-site and disposed at a POTW or industrial wastewater treatment plant. As a result of the source-control action, future surface water collected on-site is anticipated to be clean and would be directed to natural surface water drainage ways.

The goals of Alternative 5 are: 1. prevent direct contact with the landfills and lagoon, while minimizing leachate production. As leachate production decreases, the groundwater will gradually meet WDNR standards and 10^{-6} cancer risk levels for ingestion. If the sludge bearing capacity is not sufficient to allow installation of the cap, the sludge will be stabilized. Pre-design activities will determine if this is necessary; 2. protect against ingestion of contaminated groundwater and, 3. prevent leachate from contaminating the off-site surface water.

The pre-design activities required to implement Alternative 5 include developing a work plan, landfill gas sampling and air quality modeling, sludge treatability testing, and testing of the existing cap to determine if it is in suitable condition to use as a barrier layer with the new cap.

In addition, as previously mentioned, pre-design activities for this selected alternative also include the installation of a minimum of three deep bedrock wells to obtain information about the groundwater vertical gradients. If there is a downward flow component, samples will be taken to determine if there is contamination in the lower portion of the aquifer.

A monitoring program will be developed to monitor potential future off-site migration of contaminants. An initial round of samples will be taken and analyzed for hazardous compounds found on-site.

Approximately seven new off-site monitoring wells will be installed to gather water level information to supplement existing information relating to off-site horizontal flow gradients. The wells will also serve as a way to monitor potential future off-site migration of contaminants. An initial round of samples will be taken from these wells and analyzed for hazardous compounds during pre-design activities.

More information about the residential wells adjacent to the site will be collected, either in the form of well logs or by using a downhole magnet to find the depth of casing. In addition, another round of samples will be drawn and analyzed.

New soil/clay caps will be designed to meet WDNR solid waste ARARs. Groundwater ARARs are expected to be met over time. The performance of the remedy will be monitored and if groundwater ARARs are not attained, a supplemental study will be conducted. Until then, monitoring and an alternate water supply will ensure ARARs are not exceeded in drinking water. See Table 5.

ALTERNATIVE 6 - SOIL/CLAY CAPS, SLUDGE SOLIDIFICATION, AND GROUNDWATER REMEDIATION

This alternative provides a soil/clay cap over the three areas, as well as the groundwater remediation and the alternate water supply in Alternative 3. By including a source control measure that limits water infiltration through the waste, groundwater contamination under the site is expected to be reduced significantly in 10 to 20 years. The groundwater extraction and treatment system will prevent future off-site migration of the contaminants. Once the groundwater treatment system is discontinued, monitoring of the groundwater will continue on an annual basis. When five consecutive years of monitoring has shown the groundwater is reduced to the acceptable standards, the monitoring would be reduced to once every 5 years. Ponded leachate collected on the site and leachate from the Interim Expansion area will be treated in the groundwater treatment system. The surface water collected during future activities will be directed to the surface water bodies.

The goals of Alternative 6 are the same as those of Alternative 5, in addition to initially preventing off-site migration of groundwater exceeding WDNR standards and 10^{-6} cancer risk levels for ingestion.

Pre-design activity requirements are anticipated to be those described in Alternative 4 plus some testing of the existing cap to determine its suitability for use in a new cap.

Alternative 6 complies with all ARARs. See Table 5.

ALTERNATIVE 7 - MULTILAYER CAP, SLUDGE SOLIDIFICATION, AND GROUNDWATER REMEDIATION

This alternative is the same as Alternative 6 except a multilayer cap is used over the landfills and the solidified sludge. This cap provides more protection and reliability; however, it is not anticipated to noticeably affect the time estimate for the groundwater action to achieve clean-up standards. Leachate production would decrease significantly over the existing conditions (over 99 percent), resulting in reduced future contaminant levels in the groundwater. Therefore, the prospect of meeting acceptable standards in the aquifer below the site through groundwater extraction and treatment is greater with this alternative than with Alternative 6. All time estimates are based on limited data and would need revision after additional aquifer test results were available. This alternative contains the other components as described in Alternative 6 including the same goals and pre-design requirements.

Alternative 7 complies with all ARARs. See Table 5.

VIII. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives are evaluated by balancing technical considerations (implementability) with the cost and protectiveness (effectiveness) of the alternatives. This evaluation determines the most cost-effective alternative that will meet the objectives of the feasibility study for implementation at the Mid-State Disposal Site. The alternatives are evaluated against the nine criteria recommended by U.S. EPA (U.S. EPA, 1987). The criteria are as follows: overall protection of public health and the environment; compliance with State and Federal regulations, which are referred to as Applicable or Relevant and Appropriate Regulations (ARARs); long term effectiveness; implementability; short-term effectiveness; reduction of toxicity, mobility and volume; cost; state acceptance; and community acceptance. See Table 6.

A. Overall protection of human health and the environment.

A no-action alternative would not be effective in protecting either human health or the environment. Alternative 1 provides some protection through limited access by fencing and through residential monitoring.

Alternative 2 protects public health and the environment through maintenance of caps, an alternate water supply, institutional controls and by controlling surface run-off.

Alternatives 3 and 4 protect the public health and the environment through maintenance of the caps and groundwater extraction and treatment. Alternative 4 offers added protection by stabilizing the sludge and constructing a new cap for the lagoon.

Alternative 5 provides greater protection to the public health and the environment than alternatives 1 through 4 by combining the effects of an alternate water supply, stabilization of the sludge in the lagoon and the construction of new caps.

Alternate 6 includes provisions of alternative 5 and adds groundwater remediation for the protection against potential future groundwater contamination.

Alternative 7 includes the provisions of alternative 6, but it would provide only slightly greater protection of public health and the environment through the increased effectiveness of multilayer caps.

Table-6

SUMMARY OF DETAILED EVALUATION OF FINAL ALTERNATIVES[a]
MID-STATE DISPOSAL PS

Criteria	Alternative 1 No Action	Alternative 2 Alternate Water Supply, Repair Cap	Alternative 3 Groundwater Remediation, Repair Cap	Alternative 4 Sludge Solidification, Groundwater Remediation, Repair Cap	Alternative 5 Soil/Clay Cap, Sludge Solidification, Alternate Water Supply	Alternative 6 Soil/Clay Cap, Sludge Solidification, and Groundwater Remediation	Alternative 7 Multilayer Cap, Sludge Solidification, and Groundwater Remediation
Short-term effectiveness.[b]	Not effective in protecting public health and environment. No workers to protect.	Greatly reduces future risk reliably. Would be an ongoing alternative. Most protective of community and workers during implementation.	See Alternative 2.	Sludge solidification may produce odors during implementation. May be some risk to community and workers.	Provides further reduction in future risk than Alternatives 2, 3, 4 by reducing leachate production 75%. Potential risk to workers and community during implementation.	Will meet standards for offsite groundwater in 10 to 20 years. Much reduction of future risk. Potential risk to workers and community. Leachate production reduced 75%.	Similar to Alternative 4, except more likely to meet standards in time estimate. Leachate production reduced 99 percent. Potential risk to workers and community.
Long-term effectiveness and performance.	Not protective or effective. Has the greatest amount of future risk. Also has no long-term maintenance.	Greatly reduces future future risk reliably, yet requires long-term monitoring and maintenance of covers. Reliability of institutional controls is less than an extraction system.	Greatly reduces future risk reliably. Requires maintenance of treatment system.	Similar to Alternative 2 except greater reliability that sludge will no longer effect the environment.	Provides improved reliability of source control actions. Reliability of institutional controls is less than an extraction system.	Provides increased reliability and less long-term management.	Similar to Alternative 6. Long-term reliability of multilayer cap better than soil/clay cap.
Reduction of toxicity, mobility, and volume.[b]	No reduction of toxicity, mobility, or volume.	See Alternative 1	Reduces volume of contaminated groundwater.	Reduces volume of contaminated groundwater. Solidification reduces mobilization of contaminants in the sludge.	Reduces mobility of contaminants by use of solidification. Also reduces amount of leachate produced by 75 percent.	Similar to Alternatives 3 and 4. Also reduces leachate production by 75%.	Similar to Alternatives 3 and 4. Also reduces leachate production by 99%.
Implementability.	Very easy to implement.	Easy to construct and operate.	Easy to construct, operation of treatment system requires regular attention to many details for a long time.	Difficult to solidify lagoon because of considerable materials handling. Difficult to operate treatment system.	Difficult to construct cap, easier to operate because of no treatment system.	More difficult to construct Alternatives 1 - 5. Operation requirements similar to Alternative 3.	Most difficult alternative to construct because of liner. Operation requirements similar to Alternative 3.
Compliance with ARARs.	Does not meet any ARARs.	Does not meet MDNR Solid Waste regulations. May not meet chemical-specific ARARs for drinking water.	Complies with groundwater chemical-specific discharge limits. Does not meet MDNR Solid Waste regulations.	See Alternative 3.	Complies with all ARARs.	See Alternative 5.	See Alternative 5.
Overall protection of public health and environment.	Is the least protective of public health and the environment.	Provides protection against risk to human health through alternate water supply, institutional controls, and maintaining, covers. Protects surface water by controlling surface runoff.	Protects human health and the environment through source control actions and groundwater extraction. Extraction more reliable than institutional controls for protecting potential new uses of the aquifer.	See Alternative 3.	Similar to Alternative 3. Cap would reduce future contamination of aquifer even further than existing cover.	Most protective because of active aquifer restoration and leachate reduction.	See Alternative 6.
Present-worth cost.	$180,000	$3,400,000	$7,500,000	$12,000,000	$16,000,000	$19,000,000	$23,000,000

[a]Alternatives 2 through 7 contain an alternate water supply, monitoring, and fencing.

[b]Cleanup periods and percent leachate reduction are best estimates based on many simplifying assumptions and are presented for comparative purposes only.

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B. Compliance with State and Federal Regulations (ARARs)

SARA requires that remedial actions meet legally applicable or relevant and appropriate requirements of other environmental laws. These laws may include: The Toxic Substances Control Act, the Safe Drinking Water Act, the Clean Air Act, the Clean Water Act, the Solid Waste Disposal Act (RCRA), and any State law which has stricter requirements than the corresponding Federal law.

Applicable requirements are clean-up standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State Law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site. A requirement is "applicable" if the remedial action or circumstances at the site satisfy all the jurisdictional pre-requisites of the requirement.

Relevant and/or appropriate requirements are clean-up standards, standards of control, and other environmental protection requirements, criteria or limitations promulgated under Federal or State law that, while not legally "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to that site.

"A requirement that is judged to be relevant and appropriate must be complied with to the same degree as if it were applicable. However, there is more discretion in this determination; it is possible for only part of a requirement to be considered relevant and appropriate, the rest being dismissed if judged not to be relevant and appropriate in a given case" (Interim Guidance on Compliance with Applicable or Relevant and Appropriate Requirements, 52 FR 32496, August 27, 1987).

The remedial actions developed in the feasibility study (FS) were analyzed for compliance with ARARs, based on the statutory requirements outlined above. There are three divisions of potential ARARs identified for review; chemical-specific, action-specific, and location-specific.

Chemical-specific ARARs are based on exposure levels for public health and the environment. Action-specific ARARs include established technology and performance, design or other similar action specific controls or regulations. Location-specific requirements include design requirements or activity restrictions based on geographical or physical position of the site and its surrounding area. No location-specific ARARs were identified for the Mid-State site. See Table 5 for compliance with ARARs evaluation of final alternatives.

The following ARARs are potentially applicable or relevant and appropriate for the Mid-State site.

ARARS	COMMENTS
State	
Groundwater Quality Regulations (NR 140)	Groundwater standards and monitoring requirements.
Solid Waste Regulations (NR 500-520) NR 508	Monitoring requirements for solid waste landfills.
NR 506.07(3), NR 504.04(e) NR 508.04(2)	Landfill gas standards and requirements.
NR 506 .08(3), NR 504.07 NR 514.07 CH 516	Solid waste landfill cap standards and requirements.
NR 200, NR 217, NR 219, CH 147	Discharge of wastewater to surface water requirements.
Water Quality Standards (NR 100 102, 107, 108) NR 102, NR 104	Stream classifications and standards.
NR 108	Wastewater treatment or pretreatment plan review and standards.
Groundwater Extraction Wells (NR 112)	Prohibits injection wells. Standards for series of wells withdrawing more than 70 gpm.
Air Pollution Control Standards (CH 400-499)	Monitoring requirements. Standards for release to air via vents, flares, strippers.
Federal	
CWA—40 CFR Parts 122,125,403	Requirements for discharge to the Rock Creek, Eau Pleine River, or their tributaries.
CAA—National Air Quality Standards for Total Suspended Particulates (40 CFR Part 129.105, 750)	May be applicable during cap installation and sludge solidification.
OSHA--General Industry Standards (29 CFR Part 9010)	Applicable to worker safety.

OSHA--Recordkeeping, Reporting and Related Regulations	Applicable to construction records.
D.O.T. Rules for the Transportation of Hazardous Materials (49 CFR Parts 107,171.1-171.500)	Transport of contaminated material requirements.

Alternatives 5 through 7 meet and are expected to continue to meet, all applicable or relevant and appropriate requirements (ARARs).

The State of Wisconsin Groundwater Quality Regulation (NR 140) is an ARAR that specifies groundwater enforcement standards. Compliance must be met within 300 feet of the waste disposal unit or the site property boundary, which ever is less.

A monitoring program will be implemented to insure NR 140 is met.

Alternatives 2 and 5 are expected to comply with NR 140 through natural attenuation over time. An alternate water supply will ensure ARARs are not exceeded in drinking water for those furnished the alternate water supply. Alternatives 3, 4, 6, and 7 will comply with NR 140 through groundwater extraction and treatment. Alternatives 5-7 meet WDNR requirements for solid waste landfill caps, alternatives 2-4 do not.

As part of the solid waste regulation air emissions from landfill gas will be monitored, and if limitations are exceeded at the point of emission for carcinogens, flaring will be necessary to meet this portion of the ARAR. If emission limits for carcinogens are met, estimates will be made of the ambient air impact through dispersion modeling using emission rates for acute toxics.

The regulations promulgated pursuant to the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Sections 6901, et seq., are not "applicable" to this site. The RCRA regulations which governs, Hazardous Waste Treatment, Storage and Disposal Facilities (40 CFR Parts 264 and 265) did not become effective until November 19, 1980. The landfill ceased accepting wastes prior to that date.

Those RCRA regulations addressing solid waste disposal activities (40 CFR Parts 241 and 256, primarily) do not have direct application to individual facilities but rather provide for an enforcement program to be administered by the states pursuant to a Solid Waste Management Plan.

Though both Subtitle C and Subtitle D are relevant to the remedy for the Mid State Landfill, the Subtitle D provisions relating to capping/covering the landfill are deemed more appropriate. (None of the alternatives under consideration involve excavation, physical redistribution, or treatment of the waste which would make those

Subtitle C regulations applicable to "management" of waste). The appropriateness determination is dependent on whether substantive requirements are meant to address sufficiently similar circumstances as those present at the specific site to make them particularly well suited to that site. The caps that will be installed will meet the performance standards for landfill/surface impoundment covers as required in NR 504, NR 506, NR 514 and NR 516.

At this time it is not anticipated that any ARAR waivers will be needed for the alternatives evaluated.

C. Implementability

All the alternatives are easily implemented and do not have any significant obstacles. The alternatives implementing capping utilize proven techniques. Groundwater extraction and treatment is also a proven technology and will require extensive monitoring. Stabilization will require some effort to implement and will require odor control. Leachate collection and gas venting techniques used for alternatives 2 through 7 are also commonly used and proven techniques.

D. Short-Term Effectiveness

Alternative 1 is not effective in protecting the public health and the environment because there is no reduction of risk. Remedial objectives in the FS will not be obtained and, in addition, water quality criteria will not be met.

Alternatives 2 and 3 greatly reduce future risk. Risk to community and workers during implementation is limited.

Alternatives 4 through 7 may cause odors during stabilization and may involve some risk to workers.

Alternatives 5 through 7 provide further protection by reducing leachate production by at least 75%.

E. Long-Term Effectiveness

Alternative 1 would not be effective in addressing contamination at the site as it does not reduce exposure risks to the receptor population. The alternate water supply in alternatives 2 through 7 greatly reduces exposures of ingestion to potential receptors.

Alternative 4 is similar to alternative 3, but alternative 4 provides greater reliability because the stabilization and capping of the sludge will prevent direct contact of the waste and limit the production of leachate.

Alternatives 5 through 7 provide reliability of source control through new caps. Alternative 7 has the greatest reliability for source control with the multi-layer caps as compared to soil/clay caps. Alternatives 6 and 7 provide greater reliability with the extraction system as compared to institutional controls in alternatives 2 and 5.

Alternatives 2 through 7 would require long-term maintenance in order to retain their effectiveness.

F. Reduction of Toxicity, Mobility, and Volume.

None of the alternatives will reduce the toxicity or volume of the wastes at the site because all landfill waste, which will remain in place, are not subject to on-site treatment.

Alternatives 1 and 2 will have no effect on the mobility of the wastes.

Alternatives 3, 4, 6, and 7 reduce the volume of contaminated groundwater through extraction and treatment.

Alternatives 5, 6 and 7 are all designed to reduce the mobility of the wastes. As the quality of the cap is improved from alternative 5 to alternative 7, the reduction in mobility becomes more effective.

G. Cost

Each alternative was evaluated for estimated costs of implementation. Estimated costs include capital costs as well as annual operation and maintenance costs. The net present worth of these cost, provides the basis for cost comparison.

The present worth analysis was performed on all remedial alternatives using a 5 percent discount (interest) rate over a period of 30 years.

Inflation was not considered in preparing the present worth costs and a depreciation of 100 percent was assumed. The present worth costs for each alternative are summarized in Table 7.

Table 7.

COST EVALUATION OF FINAL ALTERNATIVES

Criteria	Total capital cost	First year O&M cost	Subsequent years O&M cost	Present-Worth cost
Alternative 1 No Action	$119,000	$27,700	$2,100	$180,000
Alternative 2 Alternate Water Supply, Repair Cap	$1,800,000	$220,000	$100,000	$3,400,000
Alternative 3 Groundwater Remediation Repair Cap	$4,000,000	$370,000	$210,000	$7,500,000
Alternative 4 Sludge Solidification Groundwater Remediation, Repair Cap	$8,600,000	$390,000	$220,000	$12,000,000
Alternative 5 Soil/Clay Cap, Sludge Solidification and Alternate Water Supply	$14,000,000	$220,000	$100,000	$16,000,000
Alternative 6 Soil/Clay Cap, Sludge Solidification and Groundwater Remediation	$16,000,000	$380,000	$210,000	$19,000,000
Alternative 7 Multilayer Cap, Sludge Solidification and Groundwater Remediation	$19,000,000	$380,000	$210,000	$22,000,000

H. State Acceptance

The Wisconsin Department of Natural Resources (WDNR) is supportive of remediation at the Mid-State Disposal Inc. site. WDNR fully concurs with installation of new caps and the stabilization of the lagoon sludge. The WDNR believes less expensive technologies than solidification with fly ash and kiln dust may be appropriate for the lagoon sludge. These technologies will be explored during pre-design. The U.S. EPA and the WDNR agree that the most cost effective technology that will meet the objectives of the feasibility study will be implemented.

Although contamination was not found off-site, it is not certain that the plume did not sink through fractures in the bedrock. To better understand the groundwater conditions, a minimum of three deep wells will be installed in the bedrock section of the aquifer during pre-design activities. In the event contamination is found at levels that exceed Federal or State standards for groundwater, a phased feasibility study addressing groundwater conditions will be developed and the need for remediation will be determined. In addition, U.S. EPA has agreed to model the movement of contaminated groundwater coming from the landfills and the lagoon in the shallow portion of the aquifer.

I. Community Acceptance

A public comment period was opened from July 25, 1988 through August 23, 1988 and a public meeting was held July 28, 1988 to explain the preferred remedy and solicit comments from the public. The results of the meeting and comments received from the public show the community is extremely concerned about their property values. Their main interest is for the U.S. Government to purchase all the properties surrounding the site and offer an alternate water supply. In the absence of a buy-out, the majority of the citizens support the recommended alternative. These comments will be addressed in the attached Responsiveness Summary.

IX. SELECTED REMEDY

The U.S. EPA, in conjunction with the WDNR, selects Alternative 5 as the final remedy for the site based on an across the board evaluation of all alternatives against selected criteria which include SARA Section 121 requirements, implementability, long and short term effectiveness, cost effectiveness, public health, and environmental impacts. Section 121 of SARA requires that all remedies for Superfund sites be protective of human health and the environment, and comply with applicable or relevant and appropriate Federal and State requirements. The selected remedy at the Mid-State site has the following major components:

- Alternate residential water supply.
- New soil/clay caps for the lagoon and landfills.
- Improvement of surface water drainage.
- Off-site treatment of leachate.
- Site fencing and sign posting.
- On-site road reconstruction.
- Institutional controls.
- Long-term monitoring of groundwater, surface water and landfill gas to determine the effectiveness of above measures and to provide an early indication of the need for further actions.

The following components will be evaluated during the pre-design stage:

- Landfill gas flaring.
- Sludge Stabilization.

The pre-design work at the Mid-State site will entail the collection of additional field data. Based on an evaluation of these data, the above two (2) components may be implemented.

As part of the pre-design activities for this selected remedy, a minimum of three bedrock wells will be installed to determine if any contamination exists in the deeper portion of the aquifer. An analyses will be conducted on samples from these wells. If contamination is found, a report will be prepared analyzing the significance of the results and recommending any necessary additional investigation to determine the extent of bedrock contamination. Based on the results of this report, if concentrations are in excess of Federal or State groundwater standards, a phased feasibility study will be prepared, will evaluate alternatives, and if necessary, will remedy the groundwater.

It is expected that the new caps over the lagoon and landfills will decrease leachate production by 75% and thereby decrease the potential for further contamination of groundwater on site. With less contaminated groundwater on site, the potential for contaminated groundwater moving off site is also decreased. In addition, it is expected that biodegradation and attenuation will cause contamination levels to decrease over time. Consequently, the U.S. EPA predicts compliance with the State of Wisconsin's Groundwater Quality Regulation (NR 140) over time. Approximately seven new wells will be installed to be used in conjunction with existing monitoring wells to monitor remedy performance. In addition,

these wells will gather information concerning off-site horizontal flow gradients. If the caps are not effective in decreasing groundwater contamination to comply with NR 140 in the shallow aquifer, a phased feasibility study will be prepared and will evaluate alternatives to remedy the groundwater.

It is expected the new cover will protect potential receptors from unacceptable cancer risk levels by a significant reduction of direct contact exposure.

Section 121 (c) of SARA requires that on sites where contaminants remain, the remedial action will be reviewed at least every five years to assure human health and the environment are protected. This requirement will be fulfilled through monitoring.

In addition, the Mid-State disposal site shall not be deleted from the National Priorities List (NPL) until all of the above concerns are satisfied.

X. STATUTORY DETERMINATIONS

The remedy selected must satisfy the requirements of section 121 of SARA and meet the following requirements:

A. Be protective of Human Health and the Environment

The remedy selected is based on potential future endangerment to public health, welfare and the environment. Site file records provide reasonable evidence that substantial quantities of hazardous substances and pollutants exist in the landfill waste.

The chosen alternative is protective of human health and the environment. The fencing, institutional controls and capping all provide protection from direct contact with contaminated materials. Capping of the landfills and lagoon also reduces percolation and significantly reduces the migration of contaminants into groundwater and surface water.

The alternate residential water supply will protect the public from the threat of potential exposure to contaminated groundwater. Monitoring of the groundwater and surface water will identify any failures of the containment system installed at the landfill. Should elevated levels of contaminants be detected, additional corrective measures will be taken to abate any threat.

B. Attain Applicable or Relevant and Appropriate Requirements (ARARs)

The U.S. EPA's selection of site capping will comply with applicable state solid waste landfill regulations.

The selected remedial alternative will also comply with specific public health and environmental requirements. These ARARs are called "chemical-specific" requirements. Public health and environmental ARARs expressed as chemical-specific limits or requirements will be addressed by routine monitoring of groundwater, surface water, and vented gas.

C. Be Cost-Effective

The selected remedy will comply with relevant portions of the WDNR solid hazardous waste landfill closure and post-closure ARARs. The range of alternative actions that meet closure and post-closure requirements is very limited. The chosen alternative is cost-effective since it is the least expensive alternative that satisfies the regulations. Cost-effectiveness of Alternative 5, the chosen alternative, is established relative to alternatives 6 and 7, which would cost more and essentially meet the same ARARs without significant increase in benefit to human health and the environment.

Alternative 7 has the highest capital cost due to the multi-layer cap. The multi-layer cap does not provide a significant increase of protection to justify the added cost over alternative 5. The alternatives with the extraction and treatment system have the highest operation and maintenance cost.

Although an extraction and treatment system for groundwater is very protective, the extra costs are not warranted because there is no contamination off-site and the alternate water supply provides protection against drinking groundwater that exceeds a 10^{-6} cancer risk level. Therefore, alternative 5 has been selected as the most cost effective alternative which will meet all ARARs over time.

D. Utilize Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

A permanent remedy involving treatment or recovery technologies was not selected for the Mid-State Disposal site. Permanent remedies including pumping and treatment of groundwater, and incineration of the sludge in the lagoon were evaluated and judged to be not practicable for the Mid-State Disposal site.

E. Address whether the preference for treatment that reduces toxicity, mobility, or volume as a principle element is satisfied.

SARA mandates a preference for the selection of a remedy that permanently and significantly reduces the volume, toxicity or mobility of the hazardous substance, pollutant and contaminant.

Application of treatment technologies that satisfy this preference were evaluated for the Mid-State Disposal site and found to be impracticable for the following reasons:

- Current data indicates that contaminated groundwater exists only within the legal boundaries of the site at very low levels. The threat to nearby residences is considered low and as a result of the alternate water supply and the new soil/clay caps proposed in alternative 5, the threat is virtually eliminated. Consequently, pumping and treatment of groundwater for contaminants is not cost effective.

- The size of the landfills would cause the cost of removal and treatment or disposal to be extremely high (over 30 million dollars in construction costs). In addition, segregation of hazardous waste from non-hazardous waste would be impractical. The volume of sludge material, 28,000 cubic yards, makes incineration not feasible when other technologies will provide protection and be more cost effective.

- Full ARAR compliance will be achieved over time by landfill closure which would be protective of human health and be cost effective.

Responsiveness Summary
Mid-State Disposal

The U.S. EPA must consider public comments before making the final decision to select and implement a remedial action. Public participation is required in Superfund projects according to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

The comment period for the Mid-State Disposal site was from July 24, 1988 to August 23, 1988. During that time, comments on the proposed plan were received from the public through the public meeting and through written comments. A report developed by the PRP's consultant was also submitted detailing concerns with the RI and FS reports and suggesting technologies for use at the site. The comments from these sources have been grouped and summarized. Comments on the RI are responded to, followed by comments on the FS and then comments on the Proposed Plan.

REMEDIAL INVESTIGATION COMMENTS

1. Specific areas of incomplete data were identified in a comment. These areas included extent of groundwater contamination with depth, proximity of waste materials to bedrock and upper aquifer, definition of the groundwater mound within the landfill, existence of a contaminant plume migrating off-site, the depths of the aquifer, and the characteristics of the sludge in the sludge lagoon.

Response. The issues of the proximity of the waste to groundwater and the existence of a groundwater mound have been determined. Any mound under the landfill is not significant enough to saturate any of the waste as evidenced by the borings for two landfill wells and calculations made. The other issues will be further investigated during the predesign activities.

2. Comments were raised about the use of qualified data in the RI report, including the risk assessment.

Response. No data that were qualified as present due to contamination of blanks were used in the report or in the risk assessment. Other qualified data were used with caution; however, the qualification was for the actual concentration number and not for the contaminant's presence at the approximate level indicated. Of the seven data used in determining the excess cancer risk for ingesting the groundwater (see Table 5-12 in the RI report), only one concentration was qualified. The other concentrations used were without any type of qualification.

3. No exposure concentration modeling was performed for use in the risk assessment. There was some concern over concentrations used.

Response. The no-action scenario assumes access to the site, regardless of how unlikely such access would be. Concentrations from wells directly under the landfill were not used since it is more likely new wells would

be installed next to the landfill instead of on the landfill. Also information was only used from onsite wells that represented groundwater that would be flowing in the directions indicated in the risk assessment. No concentrations from these wells were discarded from use in the risk assessment unless there was evidence that the data were incorrect. Even if a value was high, it was included in keeping with EPA's policy of using best estimates and conservative upper bound estimates for all exposure point chemical concentrations. Maximum values were used to provide a conservative estimate. The possible over- or under-estimates caused by using these assumptions were addressed in the risk assessment in tables 5-19 and 5-20.

4. A comment was made about some of the difficulties experienced during the RI, such as difficulty of obtaining background data and not filtering samples from residential wells.

Response. Because of the poor housekeeping at the site, there were some difficulties in collecting background soil data. The residential well samples were not filtered, so a direct comparison with onsite metal levels could not be made. However, as the commentor said, these difficulties do not affect the conclusions of the report. The risk assessment (which compares the data to health based levels and not to background or other data) did not identify a significant risk from the on-site soil using existing data or from the residential wells using unfiltered data.

5. A comment was made that leachate sampling and analytical results from the RI were not compared to typical leachate quality from aging landfills.

Response. Comparing leachate results to results from another landfill is difficult since each site is unique and the results of that comparison may lead to erroneous conclusions. There are no truly "typical" leachate quality results.

6. Concerns were raised about the calculations made for hydraulic conductivity, specifically over the consideration of the radial difference in the borehole versus the standpipe. Also there was a concern that the values did not match the soil-rock description given.

Response. The correct radius for the well casing and the sand pack were used in calculating hydraulic conductivity. The equation on page 9 of Appendix C shows the squared radius in the numerator is for the well casing and the radius in the denominator of the first logarithmic term is for the sand pack.

The soil descriptions used in Table TM-4-4 and Table 6 of Appendix G were not meant to identify the material as part of a soil classification system. Rather they were intended to show which of the geologic strata at the site were being tested and are only provided for the convenience of the reader.

FEASIBILITY STUDY COMMENTS

7. Two comments were made about the limited reference list in the FS and about lack of details on some assumptions and models used.

Response. The FS was based on available information and the RI report; however, standard engineering operating procedures were not referenced. To further clarify the sources of information in the FS the following references are provided:

CH2M HILL, Inc., REM IV COST ESTIMATING GUIDE, March 1987

CH2M HILL, Inc. Internal-Technology Data Base, 1986

U.S. EPA Environmental Protection Agency, Evaluating Cover Systems for Solid and Hazardous Waste, EPA-IAG-D7-1097. MERL, September 1982.

The details of models used are part of the files but were not included in the report to keep the report readable.

8. A comment was made that the state regulations (NR 500) could be met by augmenting the existing cap with sufficient cover to establish the required frost protection and root zone.

Response. On page 5-8 of the FS report it is said, "It may be possible to use some of the existing cap as a barrier layer if it is in good condition. However, for ... cost, it was assumed that the integrity of the existing cap is not sufficient." To meet NR 500 standards, the clay barrier layer needs a saturated hydraulic conductivity of 10-7 cm/s. It is unlikely that the two foot cap that has not been protected from the elements for 8 years has such a stringent conductivity. Predesign activities will be conducted to determine the integrity of the existing cap to determine if it can be used as the barrier layer in the soil/clay cap.

9. There was some concern over the details of the proposed soil/clay cap. It was thought that the cap included too many components.

Response. The cap components such as the 3.5 feet of soil and the drainage layer were based on a review of existing state standards to establish the required frost protection and root zone, and on good engineering judgement, to provide drainage of surface water to preserve the integrity of the barrier layer.

10. A comment was made suggesting that landfill gas collection be limited to existing hot spots of gas production. This would reduce the cost of gas collection.

Response. While areas of the landfill containing the most biodegradable materials may be producing the most gas at the current time, in a few years, these materials will be degraded and other less biodegradable materials will be producing gas in greater quantities in other areas of the landfill. It would be inefficient to then install gas collection pipes in those areas through the new cap. If there are hot spots of gas production in the landfill at this time, it would be efficient to install a collection well at that spot in addition to the proposed collection system. If the collection trenches are properly placed, the additional well may not be necessary.

11. It was commented that because of gas pressures in the sludge lagoon, the proposed stabilization technique would not be "successful". Another stabilization technique based on experience with the nearby Weyerhaeuser sludge lagoons was suggested which included a bark layer followed by a reinforcing geotextile, sand/gravel layer, impermeable geomembrane, and soil.

Response. Nothing in the comment indicated to EPA that the proposed stabilization technique in the FS report would not be effective in increasing the bearing capacity of the sludge. This technique is conservative and depending on results of bearing capacity tests and other sludge characterization tests, other technologies would also be investigated during the design of the action. There is some concern that the bark proposed in the comment would not be effective at stabilizing the sludge. Bark materials eventually decompose. The process of decomposition usually results in a significant loss of volume which would ultimately cause the cap to sink into the sludge. Because the comment made indicated that the commentor had experience with the suggested technology, EPA would be pleased to review the details of this technology and review the existing data on its effectiveness.

12. A comment was made that because of the low concentrations of contaminants and because contamination was not found outside of the design management zone (DMZ) (as determined by WDNR) there was little impetus for groundwater extraction and treatment.

Response. EPA agrees that health based standards (primary MCLs and WDNR standards) have not been exceeded outside the DMZ and therefore has not selected an alternative with groundwater extraction and treatment at this time. However, EPA will continue monitoring and will provide an alternate water supply as a protective measure.

13. There was a question about the purpose of the groundwater treatment system described in the FS report.

Response. The goal of the groundwater treatment system was to be protective of aquatic organisms in the tributary proposed to receive the extracted groundwater. While iron is not a health threat to humans, it is to aquatic organisms. There are federal standards regulating the iron concentrations allowed to discharge into surface water bodies. The

groundwater would be extracted because of possible future health threats to humans posed by organic compounds.

14. A comment was made that individual home treatment units would be a more cost-effective treatment than an onsite treatment system.

Response. EPA feels that an alternate water supply would be more protective in the long-term than home treatment units and therefore developed alternatives around that component. However, EPA agrees with the comment that an alternate water supply is more cost-effective than groundwater extraction and onsite treatment and therefore has selected an alternative with an alternate water supply.

15. A perimeter drain with onsite or offsite treatment of the leachate to mitigate the impacts of the groundwater was suggested.

Response. If the comment is suggesting a perimeter drain at the site boundary, the FS has considered this possibility. However, for the drain to intercept the potentially contaminated groundwater, it needs to be fairly deep and excavated into the bedrock (very expensive) (see the discussion on page 5-23 entitled extraction trenches). If the comment is referring to a perimeter drain around the landfills, this may decrease future groundwater contamination by collecting leachate from surface seeps; however, the proposed gravel blankets used under the new caps would collect this leachate. EPA will reconsider the use of groundwater extraction drains after predesign activities.

16. A comment was made that the FS did not describe the rationale used to select final alternatives from the operable unit alternatives remaining after screening.

Response. As EPA policy dictates, operable unit alternatives were evaluated with respect to effectiveness, implementability, and cost. Once these alternatives were screened to the most cost-effective alternatives that would be protective and would meet the response objectives, they were combined into site-wide alternatives. The rationale for the types of combinations used was based on common sense and on the same criteria mentioned above. It was necessary to develop a reasonable number of alternatives that would still be cost-effective while meeting the response objectives. Most of the possible combinations were evaluated if it is assumed that certain combinations of components are necessary (such as onsite treatment of leachate with onsite groundwater treatment). One that was not evaluated was use of the multi-layer cap with no sludge solidification. This would be very expensive yet there would be little control over the sludge lagoon. This was not considered a cost-effective alternative.

PROPOSED PLAN COMMENTS

17. The majority of comments on the Proposed Plan expressed the desire of the community to have the U.S. Government buy all the property surrounding and near the site.

Response.

Section 111 of the Comprehensive Environmental Response Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) addresses acquisition costs under Section 104. Section 104(j) states that property may be purchased if it is necessary to conduct a remedial action. At the Mid-State site, it is not necessary to purchase property to conduct a remedial action. To do so would be an unauthorized use of the fund. Although the Government cannot purchase the property surrounding the Mid-State site, the U.S. EPA will ensure protection of public health and the environment through implementation of the selected remedial action alternative.

18. An additional proposed alternative was identified by a commentor. The suggestion included repairing and upgrading the existing cap, installing a perimeter leachate collection system, and using the materials proposed in an earlier comment to stabilize the sludge lagoon.

Response. The individual components of this proposed alternative were addressed under the comments where they were first mentioned. EPA assumes that the commentor agrees with other components of the proposed plan such as the proposed monitoring program, the alternate water supply, the fence, the site perimeter landfill gas wells, etc. Based on results of pre-design activities, this proposed alternative may be investigated since the existing cap may meet NR 500 standards (although unlikely) and elements of the commentors sludge stabilization technique may be usable once more information about its effectiveness is available.

19. Several commentors remarked that the alternate water supply was a good idea since it would be protective and may help increase property values. It has been suggested that an alternate water supply be provided to all residents near the landfill to promote good feelings among the residents.

Response.

U.S. EPA agrees that the alternate water supply is a useful component of the alternative. There are approximately nine residents near the site. All of these residences will receive an alternate water supply rather than the initial three of four considered that are downgradient. Groundwater contaminant modeling may be done to estimate the future flow of groundwater.

20. A comment was made that federal funds should be used if necessary to remedy the site to the extent possible.

Response.

EPA agrees that federal funds will be used, if necessary, to provide the most cost-effective alternative to remedy the site.

21. It was suggested that contaminated groundwater/leachate may be migrating north through the backfill material of the natural gas pipeline that passes through the site. A well should be installed during predesign activities to determine if this is true.

Response.

The pipeline company was contacted and they say that natural materials were used to backfill the trench once the pipeline was laid. In this case, it is not likely that contaminated groundwater would have preferential migration along the pipeline to the north since this direction is up-gradient (against) the natural flow directions, however, EPA agrees this should be verified. It will be added to pre-design activities.

MISCELLANEOUS

22. The Town of Cleveland feels they should not be a PRP at this site.

Response.

EPA is currently revising it's list of PRP parties. There has not yet been an agency decision as to whether the Town of Cleveland should be deleted from the list of PRPs.

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Community Relations Guidance for Evaluating Citizens Concerns at Superfund sites		83/11/17
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